SELECTED CASE STUDIES FROM THE
PATROL FRIGATE ACQUISITION PROJECT

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THESIS

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March 1973

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from
The Patrol Frigate Acquisition Project

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ABSTRACT

The acquisition of major weapons systems is an extremely complex process involving many highly interrelated individual operations, each critical to the completion of the final product. This thesis is an examination of the Patrol Frigate Acquisition Project through the development of a series of eight case studies around the major problems that have confronted the program during the initial stages of the procurement life cycle. The case studies are designed primarily for use in graduate level systems acquisition management courses of instruction. Although the cases are intended for use in series, substantial background information has been included in each case to allow separate and individual analysis. The case subjects include project planning, DCP/DSARC, cost estimating, ship specifications, centralized procurement, contracting, Ship Project Directives, and Test and Evaluation.

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I. INTRODUCTION

The acquisition of major systems is an extremely complex process involving many highly interrelated individual operations, each critical to the completion of the final product. A prominent technique used in the acquisition of these systems is called Project Management. This well-known concept holds that by having one individual charged with the coordination of the management and financial direction of the acquisition of a system, significant reductions in cost, procurement, production and delivery times can be realized. Within the Naval Ship Systems Command a number of Ship Acquisition Project Managers (SHAPM's) for both ship and system acquisitions, have been established and are currently functioning.

The objectives of this thesis were to investigate and analyze the Patrol Frigate (PF) Ship Acquisition Program and to develop case studies around the major problems that have confronted the Ship Acquisition Project Manager (SHAPM) during the initial stages of the PF procurement life cycle. The case studies are designed primarily for use in graduate level systems acquisition management courses of instruction. Although the cases are intended for use in series, substantial background information has been included in each case to allow separate and individual analysis.

The Patrol Frigate Ship Acquisition Program was chosen because of the availability of information, the cooperation extended by the Project Office, and the several unique features of the acquisition program itself which lend application to other types of major acquisition programs such as aircraft and missiles. One notable feature is the "fly before buy" concept. The PF is also the first major acquisition program to come under the auspices of DODI 5000.1. Since the project was still in the detail design phase and the lead ship contract had not been let, the cases were limited to situations occurring prior to this milestone in the procurement life cycle.

The case method of instruction was chosen since it appeared to be the best method for in-depth study and analysis of individual problems and decisions occurring in the realm of project management. Part of the learning process is utilizing information in a way which will get participants personally involved in taking responsibility for action in one after another of concrete situations of things, people, and events. It is a method of getting at the strategic point of action, from which one may call on any and all relevant science and knowledge to develop "maximum thrust with minimum side effects" toward the goals for which the project manager must take responsibility.

The learning of project management is a unique process, unlike the learning of almost any other field. In general there is no vast body of laws and theories to be passed on to

the student. Instead, there is a body of principles whose application in a number of situations must be conveyed.

The instructor in a project management course typically has some ideas and experience with the subject for which he is responsible. Enlarging one's understanding of subjects in project management does not necessarily follow the same process of isolation and control as in the subjects of laboratory science. The process is more one of clarifying the strategic elements in the specific situation involving the subject.

The use of the term "case" is so widespread, ranging from the medical case to the law case to the business case to the social worker's case, that it is necessary to establish the meaning for which the term is used here. The term "case" shall be meant as a description of a situation or problem actually faced by a manager, and requiring analysis, decision and the planning of a course of action. However, the decision may be to delay a decision and a planned course of action may be to take no action.

Furthermore, there is a need to distinguish between the use of cases and the "case method". Cases may be used in many ways. After certain principles have been presented by lecture or assigned reading, a case may be assigned students for reading and the instructor may then lecture upon the ways in which the principles may be applied to the case. Or the students may be asked to try to apply the principles to the case as an exercise. Both of these practices would use cases; Neither would be the use of the case method.

The case method for our purposes is defined as the student discussion of a sequence of cases planned to develop within the students (1) an understanding of the principal problems of importance to the project manager in the field of activity they are studying, (2) some proficiency in producing useful ideas about ways of effectively handling the kinds of problems studied and (3) good judgment in deciding on one and in planning its effective execution by the project organization.

As a means of conveying knowledge the case method may seem disorderly and unstructured. Ideas come to the student from the data of case facts and from the discussion of them, as students and instructor all argue among themselves and challenge and support and explore each others' ideas of the pertinence of particular facts, the influence of particular considerations, the contribution of new data derived from the presented material after analysis or calculation, and the importance of various factors. The ideas come by experience, in whatever order events occur. However, an invisible structure usually underlies the apparent randomness, and the previous development of this structure through the writing, selection and sequencing of the cases, is one of the major contributions of the case writers. Without a structural basis, a case becomes meaningless, since the underlying theme and broad points will not be effectively conveyed.

This structuring is what has been attempted by the authors in these case analyses of the PF. The situations and

resulting problems facing a project office of a major system acquisition have been collected, organized and presented for analysis by the student to illustrate the "real life" applications of the principles he has been studying.

Perhaps the most important feature of the case method for training project managers is that it is situational, for the project manager is always dealing with a situation. The project manager never enjoys the economists' "long run," he works always in the short run. He never enjoys the pleasure of "other things remaining equal," for him they never do. Each problem is affected by the traditions of the organization in which it arises, the practices of the profession involved, the characteristics of the individuals concerned, and the relationships among the key program officers and civilian personnel. The project manager does not and cannot live in the generalized world of the scholar; he lives in a particularized world at a particular time with particular people, places and situations. Through its presentation of a long series of related situations, discussed under the knowledgeable guidance of the instructor as case leader, the case method is an excellent tool for learning about project management.

II. PATROL FRIGATE ACQUISITION PROJECT HISTORY

At the time of conception of the Patrol Frigate (PF) class ship, the Navy was in the process of the first large scale fleet renewal program since World War II. It was foreseen that the overdue deactivation of the remaining obsolete World War II destroyers would result in escort levels which would fall short of that needed in the 1980-time frame, even with deliveries from the DD-963, Nuclear Frigate (DLGN-58), and DE-1052 class programs.

In light of this realization and with consideration of the vigorous and ambitious effort of the U.S.S.R. in the modernization of the Soviet Navy, the Navy was pressed on two accounts: a need for rapid replacement of over-age ships and the acquisition of new ships of requisite quality and capability to cope with the Soviet threat.

In September 1970, the Chief of Naval Operations (CNO) initiated a new destroyer type feasibility study "to examine a new class ship with relatively simple equipments and few complex integrated hard- and software systems." The study objectives were:

1. To define ship characteristics and performance requirements in relation to missions and tasks; and

2. To examine alternative program costs in depth and with definite cost ceilings imposed.

By early 1971, the Navy was convinced that, subject to availability of funds, it could build an affordable yet effective ship, and CNO approved initiation of a conceptual design phase to explore the PF mission and design assumptions in greater detail. The Naval Ship Engineering Center (NACSEC) immediately began the first phase of Preliminary Design under the direction of the Naval Ships Systems Command (NAVSHIPS) PF Project Manager. CNO then used these design studies to further define the ship's characteristics.

The mission of the PF is to alleviate the urgent need for large numbers of capable but less expensive ships for the sea control mission of the Navy. The Navy expressed belief that convoy-type protection would continue to be essential into the 1980's and beyond. This relatively low-cost ship would then join the DD-963 and other open ocean escort programs by replacing the aging World War II escorts in supporting under-way replenishment groups, amphibious assault groups, and military and merchant convoys.

The PF is planned to be an essential element in the anti-submarine warfare capability of the escort force. It is designed to weather attacks of various types of anti-shipping missiles and torpedoes, both for self protection and the defense of the escorted forces. In short, the ships are to have a three-fold capability:

1. Detect and attack submarines both at long and short ranges and decoy a launched torpedo away from its target;

2. Destroy anti-shipping missiles launched from submarines, aircraft or surface ships; and

3. Launch its own anti-shipping missiles against surface targets.

The PF was envisioned as an extremely capable medium ship, but designed for the lower end of the naval warfare spectrum, i.e., use in low threat areas. The ship would not have a requirement to escort carrier task forces and, therefore, would have a much simpler command and control system. Also, it would not have a requirement for amphibious gunfire support. In short it was designed to supplement and comple- other destroyer type forces.

The unique factor of the proposed PF acquisition is the element of cost. Reduced cost was to be a major driving factor in the PF project. For the first time ever, the Navy was literally designing to a price, a firm cost threshold, while still requiring adequate ship effectiveness. The CNO stated, "In order to attain our goal in a minimum time, during a period of diminishing budgets, we are adapting many new practices and policies both in the operational and administrative fields." The progress of the PF program with these innovations is an excellent example to monitor as the Navy intends to produce a relatively large number of dollar-constrained ships to achieve a limited mission.

Although several of the technical features of the PF design are classified their relation to the procurement analysis is not significant and, therefore, will not be mentioned. The essential features of the PF design are presented in Figure 1.

FIGURE 1

PATROL FRIGATE TECHNICAL FEATURES

DESIGN FEATURES

Length Overall	440 Feet
Beam	45 Feet
Navigational Draft	23 Feet
Full Load Displacement	3400 Tons
Sustained Speed	28 Knots
Endurance	>4000 NM @ 20 Knots

CONSTRAINTS

Cost	$45.7 M*
Displacement	3400 Tons
Accommodations	185 Total

* Average follow ship cost, FY 73 dollars

In addition to these requirements several constraints are imposed. A price ceiling for the follow ships was established at $45.7 million. The full load displacement was not to exceed 3400 tons. Finally, the crew (Officer and Enlisted) was not to exceed 185. These figures were constraints not goals. They were upper limits, not to be exceeded, and lowered if possible. The design philosophy was that if a constraint was exceeded, then some other features or equipment on the ship had to be reduced or eliminated. In fact such a trade-off was necessary when a second helicopter was added to the design.

With these goals and constraints in mind the procurement planning of the PF class was initiated. The PF Ship acquisition Project was set up under NAVSHIPS as PMS 399 with Captain E.J. Otth, USN as Ship Acquisition Project Manager (SHAPM). The initial project organization is depicted in Figure 2. Three of the four major operating divisions were of a conventional nature. They were:

1. Management, which included cost control, financial matters, planning and scheduling, and appraisal and reporting;

2. Procurement and production, which included cost of Government Furnished Equipment, configuration management, production planning, and installation and test management; and,

3. Integrated logistics support, which included personnel and training, maintenance planning and supply support, and data management.

The fourth major organizational group was in the technical area and was handled differently. The principal technical assistant to the SHAPM was Captain John Orem as Ship System Manager. He was to serve in two billets, one in the SHAPM

PF SHIP ACQUISITION PROJECT ORGANIZATION

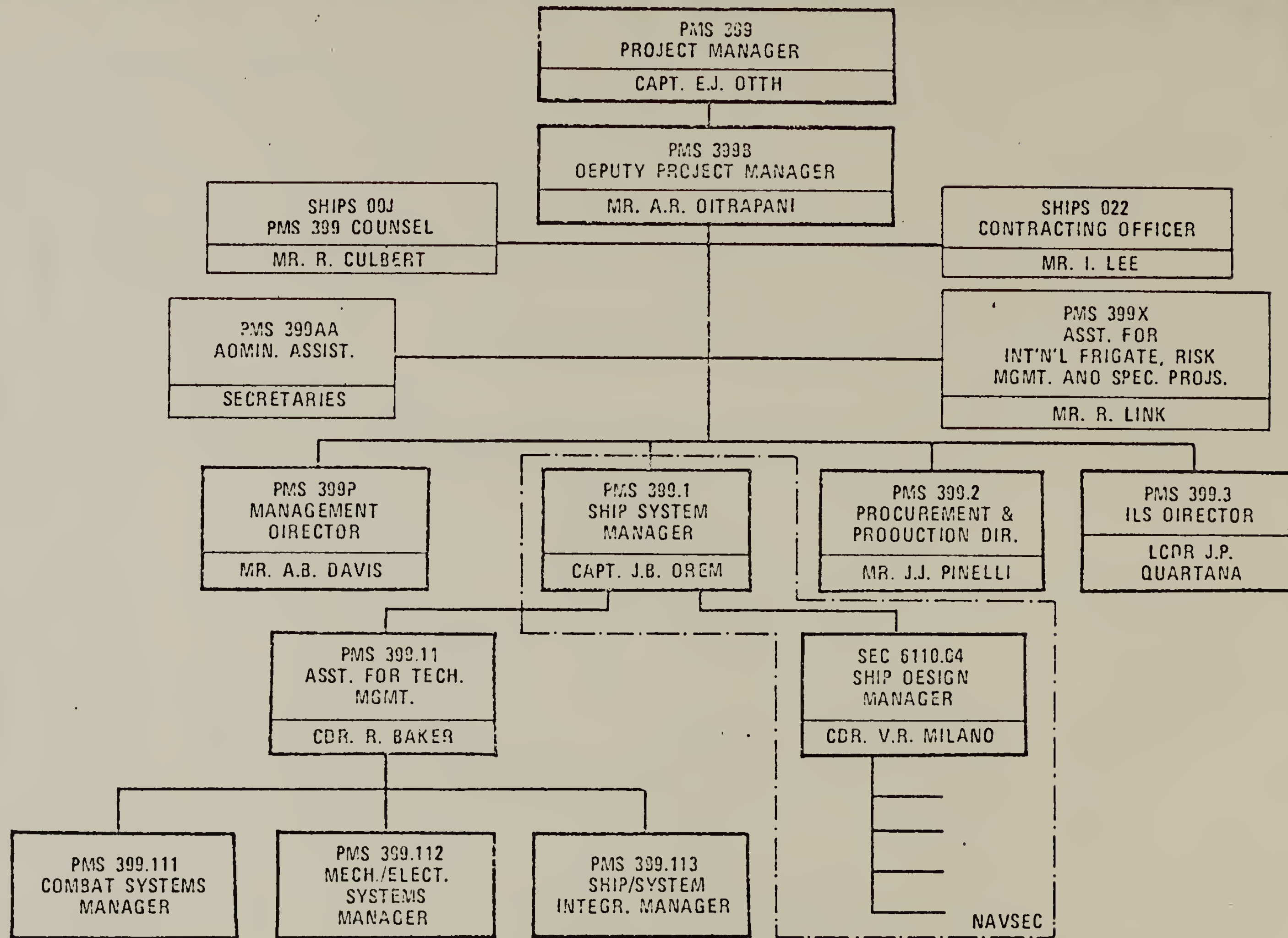


Figure 2

organization as previously depicted, and one in NAVSEC. Figure 3 summarizes both the NAVSEC functional organization and the NAVSEC PF Project Office organization. The PF Ship Design Manager reported directly to Captain Orem and was responsible for directing the PF Ship System Design effort of NAVSEC through the PF Task Group Managers. The Task Group Managers, in their respective discipline areas, worked through the NAVSEC functional organization. The result was a functional matrix organization.

The features of the procurement plan are presented in Figure 4 and indicate the major acquisition phases of the procurement program. The Ships System Design (SSD) would be developed by NAVSEC and defined in a series of four technical baselines. The two parts of the Conceptual Phase were to establish the PF Functional Baseline prior to DSARC 1. After approval of the Secretary of Defense (SECDEF) and based on proposals submitted in response to the Navy's RFP, two shipbuilders were to be awarded Cost Plus Fixed Fee (CPFF) contracts for SSD support. One of the shipbuilders would be designated as the lead shipbuilder and do the Detailed Design. This shipbuilder will be referred to as Shipbuilder (or Contractor) A and the other design support contractor will be referred to as Shipbuilder B.

After the awards, development of the Preliminary Allocated Baseline would commence. Shipbuilders A and B would assist in design reviews and special studies concentrating principally on the producibility aspects, although other areas would be

NAVSEC ORGANIZATION FOR PF SHIP SYSTEM DESIGN

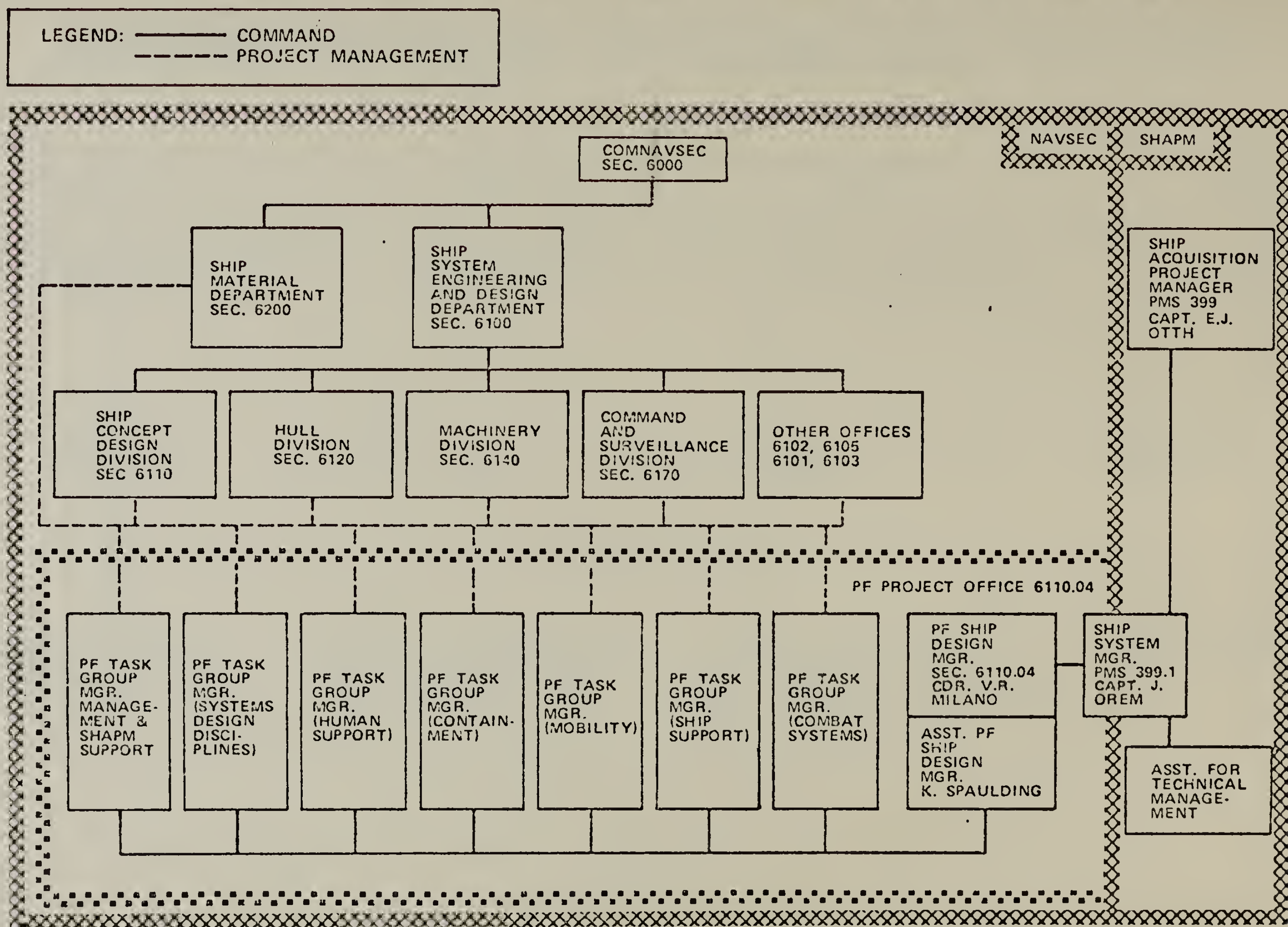


Figure 3

PATROL FRIGATE ACQUISITION PHASES

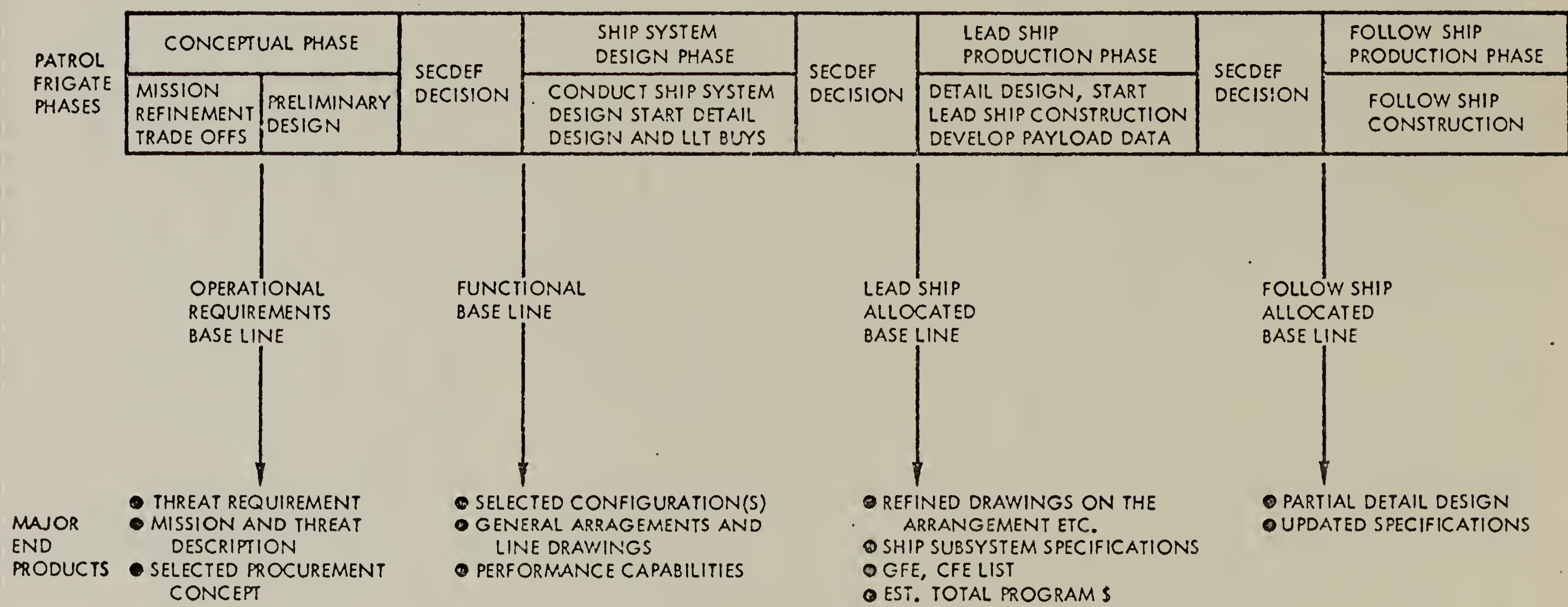


Figure 4

covered as well. This phase would be terminated at DSARC 2.

Following review and comment on the Preliminary Allocated Baseline by Shipbuilders A and B and participating Naval activities, NAVSEC would prepare the Lead Ship Allocated Baseline. This baseline would be the technical basis for the lead ship production contract. Shipbuilder B would not participate beyond the establishment of the Lead Ship Allocated baseline. He could, however, compete for the follow ship awards.

At an appropriate time, possibly before but not later than award of the lead ship production contract, Shipbuilder A would be authorized to proceed with Detail Design, depending upon the availability of funds and the technical progress to date. Approximately 18 months after establishment of the Lead Ship Allocated Baseline, NAVSEC would establish the Follow Ship Allocated Baseline to serve as the basis for the follow ship production contracts. In preparing the Follow Ship Allocated Baseline, NAVSEC would utilize information derived from the Detail Design.

A more detailed look at the conception of Shipbuilders A and B and their support of NAVSEC in SSD is presented in Figure 5. This flow chart indicates the inter-relationship of the SSD support contract line items, or tasks. It should be noted that the horizontal time based scale is not linear. Figure 6 presents the procurement plan on a time scale with planned dates indicated. Following evaluation of the

WORK FLOW DIAGRAM

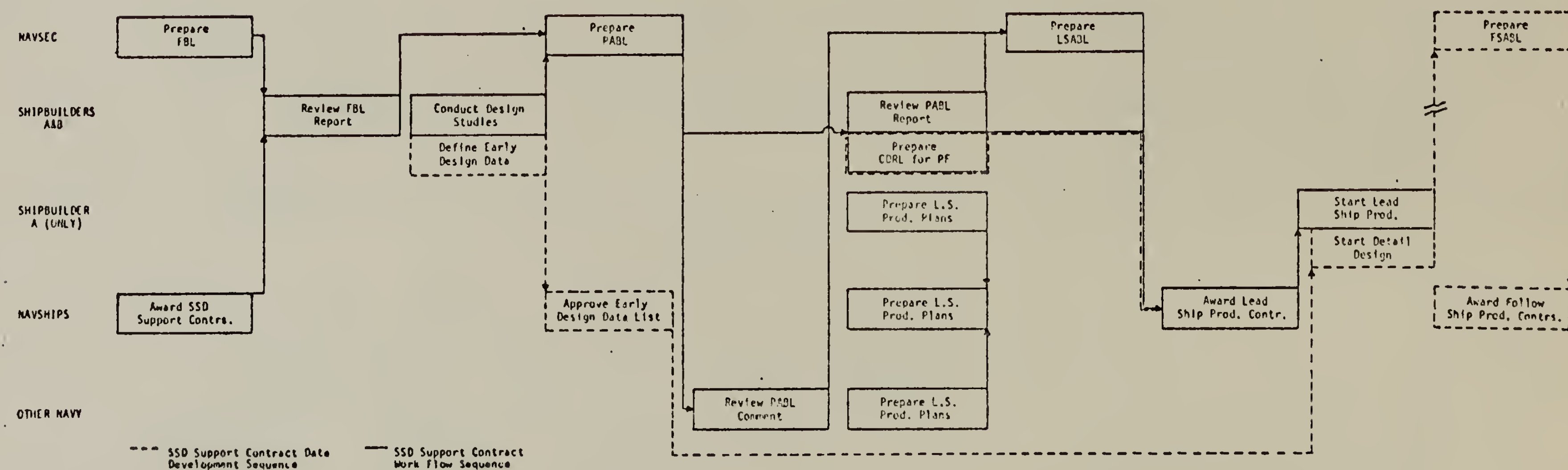


FIGURE 5

PATROL FRIGATE PROCUREMENT PLAN

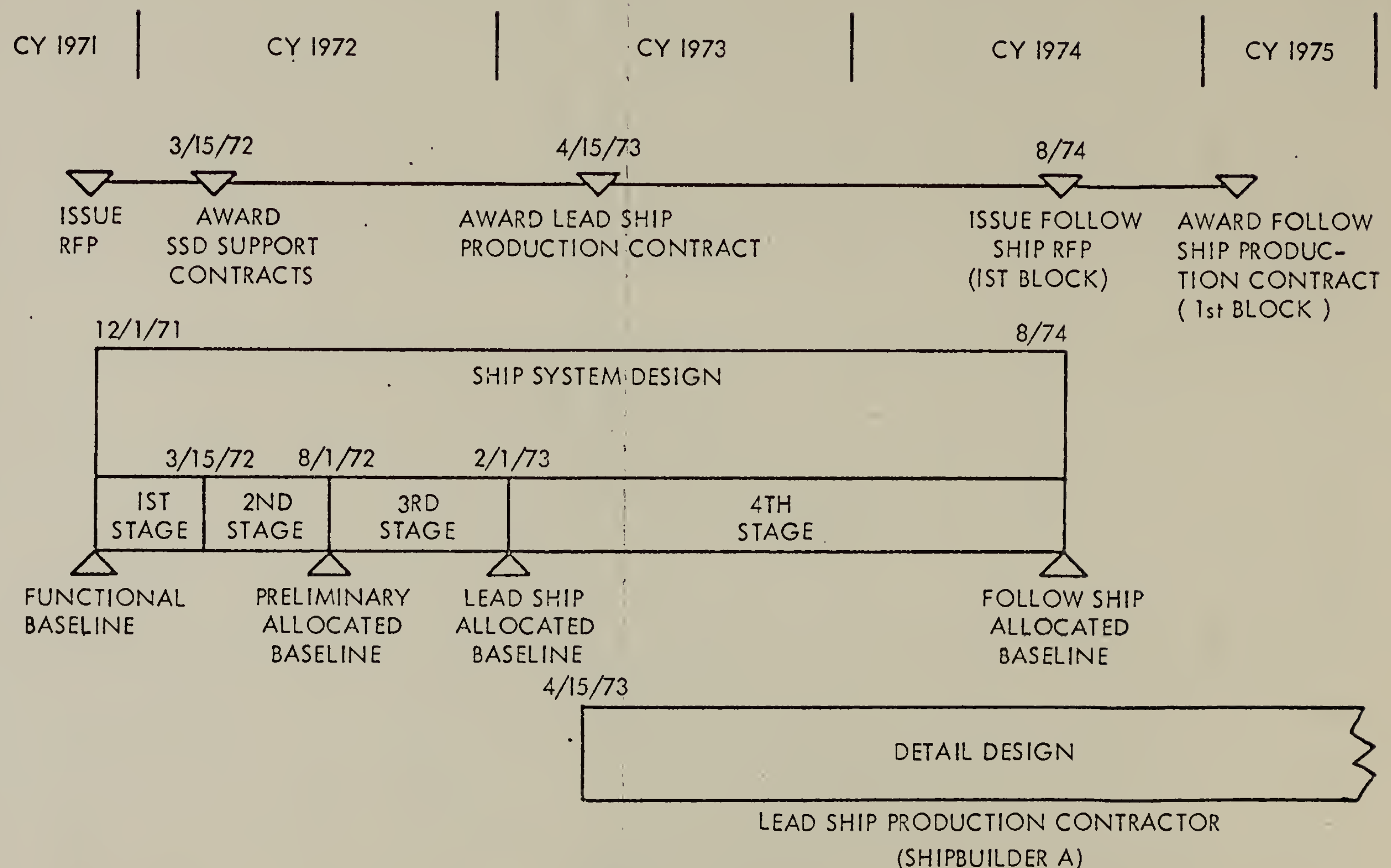


Figure 6

proposals, contracts were awarded to Bath Iron Works Corporation as Shipbuilder A and Todd Shipyards Corporation as Shipbuilder B.

Contracts for the follow ship procurements were tentatively to be in two batches of 24 and 25 each over a five year period. Awards were to be given to three yards on a competitive basis. Ship deliveries would be at the rate of about one per month. Figure 7 depicts the procurement plan for contract award and ship production.

A primary innovative concept of the PF procurement plan was the combination of proper lead/follow ship phasing, extensive land-base testing, and detail-design validation before extended application. This concept then would fulfill the intent of prototyping the design. Long delays inherent in prototyping would be avoided in the total-program ship acquisition, while allowing reasonable establishment of the grounds for producibility of the follow ships.

P F PROCUREMENT UNDER TWO-BLOCK SERIES PRODUCTION SERIES

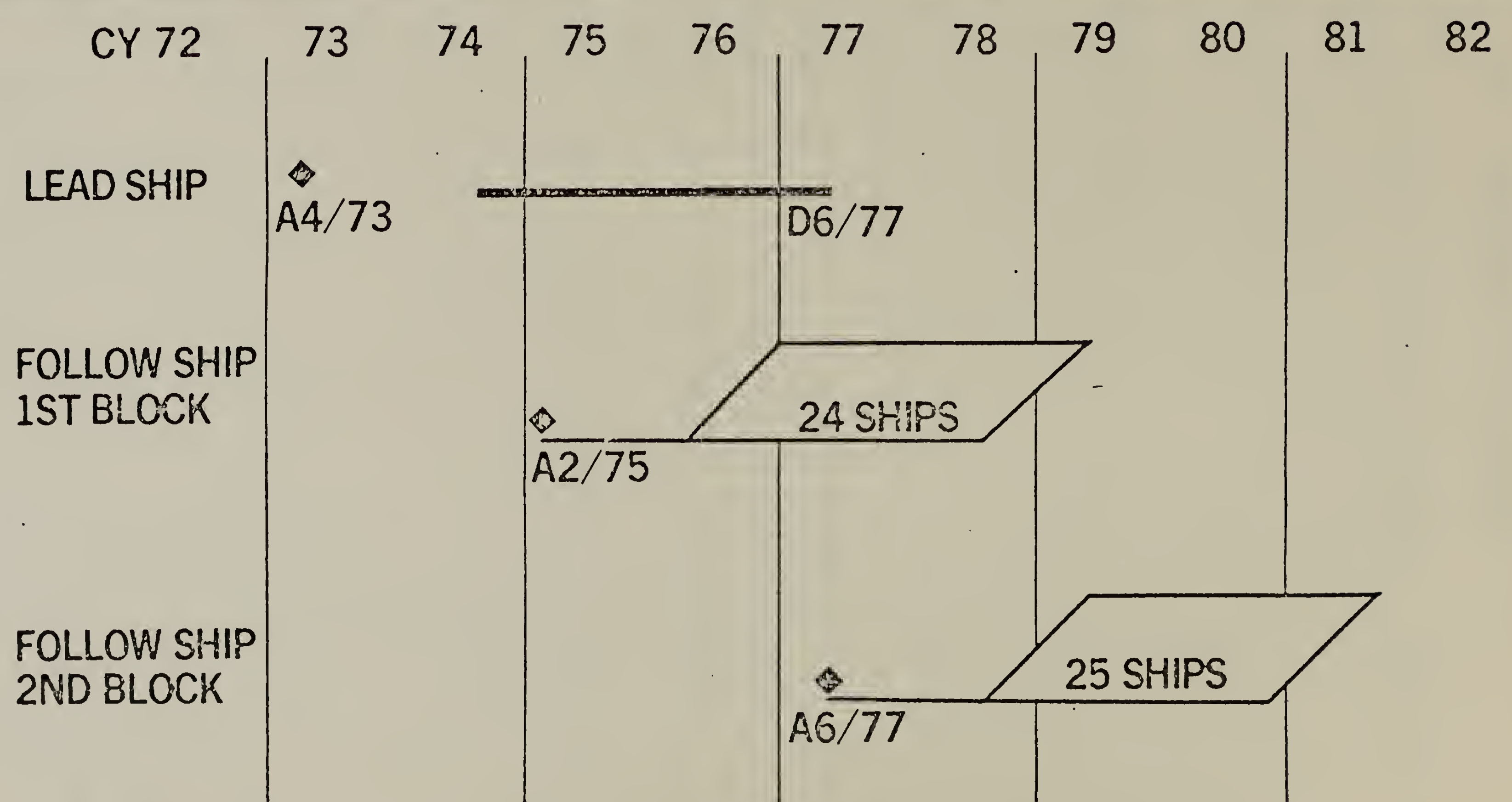


Figure 7

III. SUMMARY OF THE CASES

A time-phased diagram of the PF procurement life cycle indicating the chronological progression of the cases is presented in Figure 8. A brief description of each case follows.

A. PROJECT PLANNING CASE

This is a two-part case dealing with early long range planning of an acquisition project. The analysis made in this case should result in the determination of appropriate procurement methods for the project.

The first part of the case is a consideration of the various procurement alternatives and an application of analysis techniques in order to determine procurement methods to be used.

The second section of the case requires the preparation of the Advanced Procurement Plan for the project using the results of the above analysis and other data supplied.

B. DCP/DSARC CASE

This case investigates the roles of the Development Concept Paper (DCP) and the Defense System Acquisition Review Council (DSARC) in the procurement life cycle of a major weapons system. The current DCP/DSARC process as formally stated in DOD Directive 5000.1 of July 13, 1971 is reviewed and analyzed. The DCP/DSARC process applicable to the

Patrol Frigate (PF) is presented, and the unique problems associated with conventional hull ship acquisition programs are discussed. Alternative proposals to the present DCP/DSARC process are considered. The student is required to prepare an outline for a DCP and a DSARC presentation.

C. COST ESTIMATING CASE

This case deals with budget cost estimating for the Patrol Frigate (PF) as an example of costing in a major acquisition project. The analysis made in this case should demonstrate some of the problems of early budget estimating, the use of cost estimating relationships and other techniques, and the accuracy involved in these tasks.

D. SHIP SPECIFICATION CASE

This case investigates the concept of ship acquisition specification. The first part of the case explains how technical requirements are made known to ship designers and shipbuilders through the medium of specifications. Problems in obtaining the proper mix of performance-type and design-type specifications to meet requirements of each step of the Patrol Frigate procurement cycle are considered. Although specifically addressing ship specifications, this same general problem exists for other systems. The second part of the case involves a review and an analysis of two separate specification package proposals. The student is required to determine the advantages and disadvantages of each specification package using the criteria included in the case for guidance.

E. CENTRALIZED PROCUREMENT CASE

In shipbuilding a substantial fraction of the total cost is due to equipment installed on the ship by the builder. This equipment falls into two general classifications: that equipment which is furnished by the government for installation by the builder is called Government Furnished Equipment (GFE) or Government Furnished Material (GFM); that equipment which is not furnished by the government is procured by the builder for installation and is referred to as non-GFE or non-GFM. This case deals with the problems regarding procurement of this latter type of equipment, non-GFE, for the Patrol Frigate (PF) acquisition. These problems are complicated by the production of the follow-ships of the class in a number of shipyards and the desire to procure the equipment using a central agency.

F. LEAD SHIP PRODUCTION CONTRACT CASE

This is a two-part case dealing with the structuring decisions for the lead ship production contract for the Patrol Frigate (PF). This contract, while basically a production contract, has development characteristics because of the nature of lead ship production. The use of options and incentives are considered.

The first part of the case deals, essentially, with long range planning of the contract structure while the second part introduces a few of the more complex problems which had to be dealt with as the time of award of the contract approached.

It is recommended that students consider Part A of the case first and without knowledge of Part B. Once they are satisfied with their analysis of Part A, then the complications of Part B will present interesting sidelights into program management.

G. SHIP PROJECT DIRECTIVE CASE

This case investigates the role of the Ship Project Directive (SPD) in the management of a major ship acquisition project. The major aspects of NAVSHIPS SPD Instruction (7000.29B) are reviewed and summarized. Relationships between the Ship Acquisition Project Manager (SHAPM) and the Secondary Managers are discussed. Problems encountered with SHAPM primacy, reporting requirements, cost estimates and financial reports, funding deficiencies and changes, and timing of initial SPD preparation are cited. The student is required to analyze these problems and prepare recommendations for their correction.

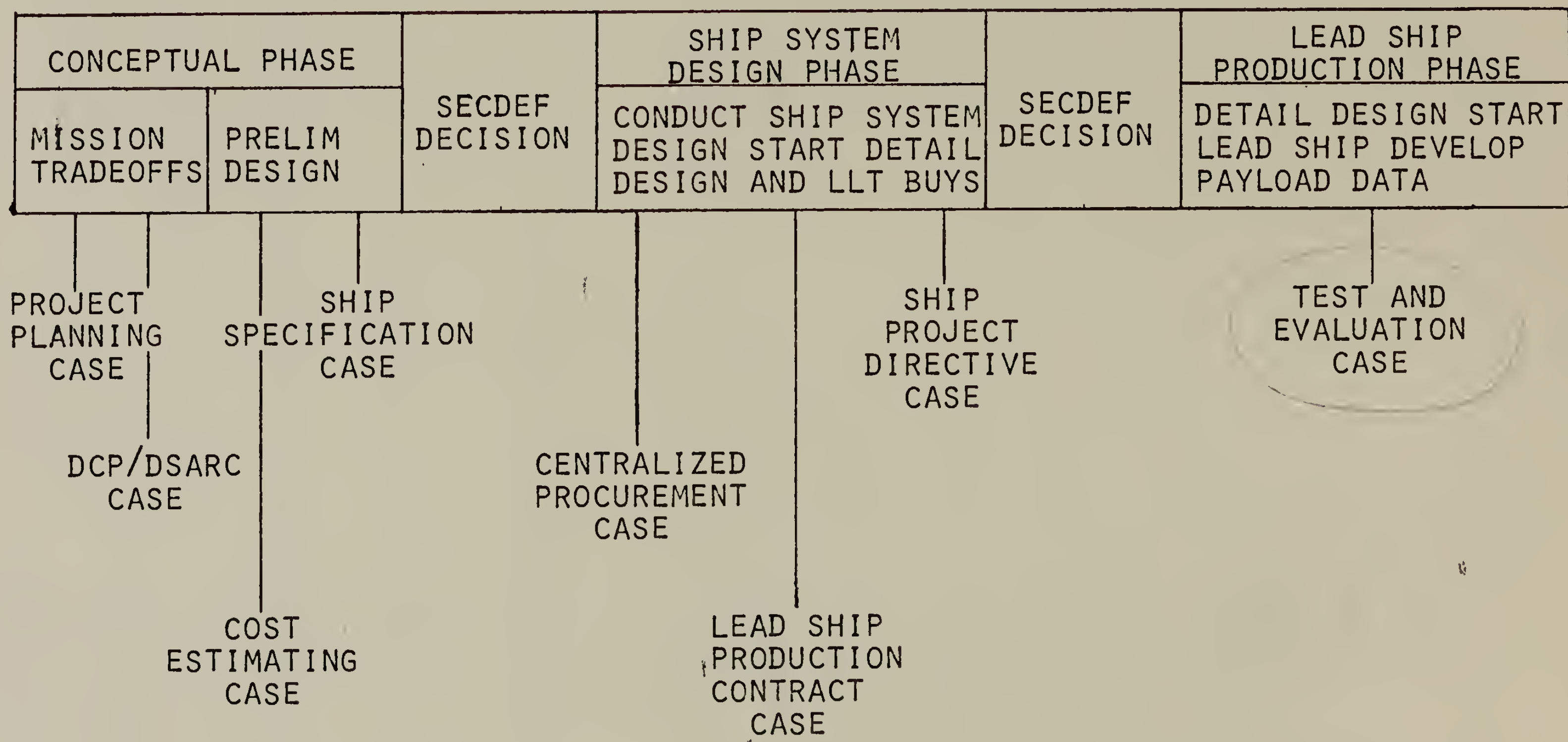
H. TEST AND EVALUATION CASE

This case investigates the Operational Test and Evaluation (OT&E) process in the procurement life cycle of the Patrol Frigate. The case studies some of the recent changes in test and evaluation concepts brought about by the recommendations of the Blue Ribbon Defense Panel and DODI 5000.1. The initial Patrol Frigate test and evaluation plan is reviewed and then contrasted with the two alternative plans. Major issues concerning Land Based Test Sites, whole-ship

Initial Operational Test and Evaluation, and number of shipyards to be used are considered. The student is required to develop his own test and evaluation plan for the Patrol Frigate using the proposals included in the case as guidance.

FIGURE 8

TIME SEQUENCE OF THE CASES



APPENDIX A

PROJECT PLANNING CASE

A. BRIEF

This is a two-part case dealing with early long range planning of an acquisition project. The analysis made in this case should result in the determination of appropriate procurement methods for the project.

The first part of the case is a consideration of the various procurement alternatives and an application of analysis techniques in order to determine procurement methods to be used.

The second section of the case requires the preparation of the Advanced Procurement Plan for the project using the results of the above analysis and other data supplied.

B. OBJECTIVES

The objectives for the student considering this case are:

1. To gain understanding of the principles of procurement planning.

2. To understand the Department of Defense and Navy requirements for advanced procurement planning.

3. To apply some of the analysis techniques used in advanced procurement planning.

4. To gain insight into the role of the project manager in advanced procurement planning.

C. BACKGROUND

Advanced Procurement (AP) planning may be defined as a series of decisions directed to the integration of procurement, technical, and financial plans during the weapon system acquisition cycle. The goal of AP planning is to obtain a successful weapon system, in a timely manner, at the lowest total cost to the Navy. This is accomplished by the documentation, at an early point in time, of the long range contractual method or methods which will be utilized for the procurement by contract of both the development and production of an individual item or system.

The project manager is responsible for AP planning and for the preparation and approval of the Advance Procurement Plan (APP) that documents his planning. This responsibility may not be delegated, although assistance from a variety of disciplines is available including requirements, technical, financial, ILS, legal as well as procurement personnel. Project managers must, therefore, be familiar with the procurement techniques and methods for accomplishing the project at lowest total cost commensurate with the Navy's requirements. They must be aware of general considerations such as competition, contract type, source selection, and so forth, that are a part of and affect each individual procurement action.

An APP is the documentation of the project manager's efforts in AP planning. Its format and content requirements are prescribed in ASPR 1-2100, Advance Procurement Planning. Essentially it is a description of the analysis made in the planning, a listing of the procurement goals and objectives for the project and a milestone schedule.

A critical part of every APP is the milestone chart. These milestones focus attention on the time element required to achieve the proposed procurement objectives. The key milestones may differ to some degree in each procurement, reflecting the particular circumstances or conditions of that procurement; but, the critical milestones of each program that effect the procurement actions require identification and inclusion in the plan.

D. REQUIREMENTS

The requirement for the first part of this case is to perform the analysis required and define the ship procurement method. The objectives of the analysis are:

1. To analyze current methods of ship procurement.
2. To select the method must appropriate for acquisition of PF ships.
3. To develop the method into a procurement plan.

Minimal initial constraints of two kinds are imposed on the analysis: explicit and implicit. The explicit constraints derived from the program objectives and prior planning are included in the PF Conceptual Phase Plan.

These are:

1. The lead ship production contract was to be awarded in the fiscal year identified in the program plans.

2. Shipbuilder input was to be obtained early in the design process.

3. Only private (not naval) shipyards were to be considered for production.

4. The ASW lead ship was to precede the AAW ship, but both were to be produced by the same shipbuilder. (This constraint lost practical significance when the decision was made to drop the ASW version.)

5. The procurement plan must be compatible with funding plans under consideration.

The principal implicit constraint is that the recommended procurement plan has to comply with the ASPR and existing DOD and Navy directives.

The following major factors are to be considered in evaluating alternative approaches to the procurement:

1. Feasibility of awarding the lead ship production contract by the date desired.

2. Provision for maximum competition for follow ships under a multi-year approach.

3. Provision for standardization of ships built at different yards.

4. Provision for Navy participation during contract design.

5. Provision for follow yard review of the evolving contract design.

6. Availability of timely and accurate information for follow ship construction.

7. Provision for ensuring that selected shipbuilders especially the lead ship builder, are thoroughly familiar with the bid package and ship performance requirements.

Four major criteria are to be used in the selection of alternative methods of procurement:

1. Schedule. The strongly expressed desire of the Navy to achieve an earlier than ususal award of the lead ship production contract was of paramount importance.

2. Program Cost Credibility. Two governing considerations in the selection of an approach to the PF procurement were the requirements (i) to have realistic estimates of program costs at the time the contract for the lead ship is awarded and (ii) to procure all ships at a cost equal to or less than that estimated.

3. Contractor Assumption of Responsibility for Performance. The procurement process for the PF Program was to place a major part of the responsibility for ultimate ship performance on the contractor, with the Navy retaining a high degree of control over the ship's technical design.

4. Acceptability. The procurement method selected was to be acceptable not only to those who must approve the program for the government but also to those within industry who must respond within the framework of the government approval action.

The first step in the analysis has been completed. The major procurement-oriented considerations that Navy management must address have been identified. Eight major factors have been defined and are shown in Figure 1. The options open to management decision at each point have been determined and are listed with the decision.

As indicated in Figure 1 , ship design and ship system engineering were considered as a singly decision area with six options. Support engineering planning was a separate decision area with three associated options. Since the options in these two decision areas are relatively independent, the number of possible combinations is six times three, or 18, a manageable number.

Figure 1

OPTIONS OPEN FOR MANAGEMENT DECISION

DECISION AREA	OPTIONS
1. Type of Specification	. Performance . Design (Construction)
2. Ship Design and Ship System Engineering	. NAVSEC . NAVSEC with outside assistance, including naval shipyards . Design agent/lead ship builder . Industry, with competition for lead ship, followed by competition for follow ships . Industry, with one competition for lead ship plus some follow ships . Industry for design and system engineering only, with subsequent competition for both lead and follow ships
3. Support Engineering Planning	. NAVSEC with outside assistance . Outside contractor(s) reporting to NAVSHIPS . Naval activities other than NAVSEC

Figure 1 (Cont'd)

DECISION AREAS	OPTIONS
4. Program Management	. Navy with outside assistance . Contractor (different from that used in decision areas 2 and 3, if used at all) . Contractor (same as that used in decision areas 2 and 3, if used at all)
5. Production and Procurement Planning	. NAVSEC . Design agent/shipyard . Shipyard (lead ship)/ shipyard (follow ship) . Naval shipyard
6. Cost Estimation/ Validation	. Navy, including shipyard bids . Independent, including shipyard bids
7. Production Options	. One yard to produce all ships . One yard to produce lead ship plus some follow ships; yards for remaining follow ships . One yard for lead ship; yards for follow ships, possibly awarded at intervals
8. Construction Options	. Conventional (keel-up) . Modular (final assembly at shipyards)

For the purpose of further analysis, the elements that make up the 18 possible combinations remaining were arrayed in the form of a decision tree, as shown in Figure 2. The six options or alternative sources for ship design and ship system engineering are shown in the left column and are referred to as branches. The three options or sources for accomplishment of support engineering planning--any one of which can be chosen with each of the six options for ship design and ship system engineering--are shown repetitively in the right column, referred to as limbs. The three lower branches (left column) that show industry performance of ship design and ship system engineering also indicate the general method of procurement for production of lead and follow ships. This is because these methods differentiate the way in which industry would perform in the design role.

Working from the top down on Figure 2, each combination of branches and limbs was examined for the purpose of eliminating the options that were not viable. It was concluded that NAVSEC alone could not handle both ship design and ship system engineering because:

1. NAVSEC's current and prospective work load is such that there would not be sufficient manpower and other resources to cover so much additional work.

2. NAVSEC probably lacks sufficient detailed knowledge and historical data to perform the work at the level established by its own standards. Accordingly, this top branch and its limbs, a total of three combinations, were eliminated.

Similar reasons dictated against the second branch and its top limb which add support engineering planning to ship design and ship system engineering. It was considered that

Figure 2

PROCUREMENT OPTIONS FOR SHIP SYSTEM DESIGN,
SHIP SYSTEM ENGINEERING, AND SUPPORT ENGINEERING PLANNING

Alternative Sources for Ship Design and System Engineering:	Alternative Sources for Support Engineering Planning:
NAVSEC	NAVSEC With Outside Assistance Other Contractor(s) Reporting toNAVSHIPS Naval Activities Other Than NAVSEC
NAVSEC With Outside Assistance, Including Naval Shipyards	NAVSEC With Outside Assistance Other Contractor(s) Reporting to NAVSHIPS Naval Activities Other Than NAVSEC
Design Agent With Lead Ship Builder	NAVSEC With Outside Assistance Other Contractor(s) Reporting to NAVSHIPS Naval Activities Other Than NAVSEC
Industry, With Competition for Lead Ships; Followed by Competition for Follow Ships	NAVSEC With Outside Assistance Other Contractor(s) Reporting to NAVSHIPS Naval Activities Other Than NAVSEC
Industry, With One Competition for Lead Ship Plus Some Follow Ships	NAVSEC With Outside Assistance Other Contractor(s) Reporting to NAVSHIPS Naval Activities Other Than NAVSEC
Industry for Design and System Engineering Only; with Subsequent Competition for Both Lead and Follow Ships	NAVSEC With Outside Assistance Other Contractor(s) Reporting to NAVSHIPS Naval Activities Other Than NAVSEC

the burden of this design effort would be an unnecessary strain on NAVSEC's resources--even with assistance. Therefore, this branch/limb combination was eliminated, although the two other limbs on that branch were left for further consideration.

Any combination of ship design and ship system engineering which was to be performed by industry using Navy facilities other than NAVSEC for support engineering planning was eliminated from the remaining branches. It was concluded that neither a design agent nor a shipbuilder could exert the necessary control over or establish (within the time required) the necessary interface with Navy facilities to ensure that the work would be done efficiently and expeditiously.

These eliminations left only ten of the 18 possible combinations mentioned above. At this point in the analysis, each of the ten combinations was considered in relation to the type of specification that might be used in the PF program: a performance-type specification, a design-type specification, or a mix of the two. While the type of specification used does bear on the method of ship system design procurement, it was not considered an overriding factor.

The second requirement of this case is the preparation of the APP for the PF. The Student is to now assume the role of Project Manager. Much of the information needed for this task has been developed in the previous analysis. The remainder of the information required is presented in Enclosure (1) to this case. Included as Enclosure (2) is the ASPR, Article 1-2100 Advance Procurement Planning and as Enclosure (3) is the NPD, Article 1-2100 Advance Procurement Planning. These are the applicable directives to guide the Project Manager in his efforts.

E. DATA

Enclosure (1): Summation of procurement data.

Enclosure (2): ASPR, Article 1-2100, Advance Procurement Planning

Enclosure (3): NPD, Article 1-2100, Advance Procurement Planning

Enclosure (4): Example Advance Procurement Plan for the SUNLAMP Missile System (fictitious example presented for illustrative purposes only).

ENCLOSURE 1

SUMMARY OF PROCUREMENT DATA

1. The objectives of the Patrol Frigate (PF) Program are to define ship characteristics and performance requirements to minimize ship size and cost consistent with mission requirements, to estimate total program costs with accuracy, and to produce the PF ships at or below the program cost estimates.

2. The mission of the PF is to supplement and replace existing and planned ASW and AAW escort ships in protection of amphibious forces, underway replenishment groups, and military or mercantile convoys against air, surface or submarine threats.

3. The PF characteristics are as follows:

Length at waterline	430 feet
Beam	43.7 feet
Full load displacement	3400 tons
Sustained speed	28.1 knots
Propulsion	gas turbine
Propeller shafts	single

4. Funding for the total 50-ship procurement is based on the following schedule:

FY	73	74	75	76	77	78	79
Ships	1	3	7	12	12	12	3

5. All PF ships will be constructed by private yards. Competitive selection of a shipbuilder for the lead ship, to participate in the ship system design with NAVSEC, is planned for February 1972, followed by the award of the FY 1973 lead ship construction contract to that shipbuilder in February 1973. Multi-year contracts for the remaining 49 ships will

be awarded in June 1974 to three competitively-selected shipbuilders, one of which may be the lead yard.

6. Other major milestones are as follows:

Release RFP for SSD	11-71
NAVSEC Start SSD	11-71
Shipbuilder Start SSD	2-72
Start LLT GFE Buys	6-72
Start Detail Design	6-72
Deliver Lead Ship	12-76
Deliver First Follow Ship	4-78
Deliver Last Follow Ship	4-82

It is planned that the lead ship will be 32 months in construction and the follow ships will require 28 months initially, improving with learning to 24 months. With three yards at work, with concurrent contract detail design by the lead yard, and with prior year advance material procurement, it is expected that a ship delivery rate of one ship per month will be achieved.

Part 21—Advance Procurement Planning

1-2100 Advance Procurement (AP) Planning.

1-2100.1 *General.*

(a) Advance procurement (AP) planning is the means by which the efforts of all personnel responsible for the procurement of defense material by contract are coordinated as early as practicable in order to obtain required items of the requisite quality, on time, and at the lowest sound price. It involves the prospective analysis of requirements and the documentation of technical, business, policy, operational, and procurement considerations into a comprehensive procurement plan. These considerations include all operational requirements (time and mission goals), technical objectives (performance, reliability, etc.), economic factors (potential costs), use of appropriate contract techniques, and compliance with procurement regulations and policies. Potential conflicting interfaces and any resulting essential trade-off decisions must be recognized to accomplish a sound material procurement program. In the planning phase, it is necessary to determine what management systems will be required during the life of the program. Planning for management of the acquisition should be included in advanced procurement planning. (See 1-331.) Advance procurement planning establishes and graphically portrays realistic milestones to be met in achieving the goals of a specific program. The Advance Procurement Plan (AP) serves as the principle long-range procurement planning document charting the course of major procurement programs over their life-cycle, keyed to the Department of Defense Five Year Defense Program.

(b) System/Project Management Plans comprise a total management approach for acquiring a system or project intended to meet an approved requirement. The AP Plan covers the contractual plans for acquiring such a system or project.

(c) The development of the AP plan covering the contractual plan shall include a best effort to plan for the use and establishment of necessary facilities in or near sections of concentrated unemployment or underemployment and areas of persistent or substantial labor surplus.

1-2100.2 *Applicability.*

(a) While the AP planning provided for herein applies to the more complex and costly programs to procure hardware developed and produced to satisfy the need for modern military equipment, its principles may also be adapted to the procurement of all supplies and equipment. Although some degree of AP planning is necessary to buy even shoes, subsistence, or other common items of supply, the formal, complex, and detailed AP planning described herein is not applicable to such items. AP planning of the character and scope provided for herein may cease at such time as requirements are procured by means of formal advertising.

(b) AP Plans shall be prepared for negotiated hardware development and production procurements in accordance with the guidelines set forth in 1-2102, for:

(i) development procurements described in 4-101(a) (3) through (7) estimated at $300,000 or more for any fiscal year; and

(ii) production procurements estimated at $1,000,000 or more for any fiscal year.

However, this shall not be construed to require the preparation of an AP Plan for an individual emergency procurement, negotiated pursuant to 3-202, which is not already covered by an approved plan.

(c) Items governed by the Department of Defense High Dollar Spare Parts Breakout Program (AR 715-22, NAVMATINST P4200.33A, MCO P4200.13A, AFR 57-6, DSAM 4105.2) are not covered by this paragraph.

1-2100.3 *Initiation of Advance Procurement Planning.*

(a) AP planning shall be initiated at the time the Technical Development Plan (TDP) is initiated, which normally is upon entrance into the advanced development category of research and development effort as discussed in 4-101 (a)(3). AP Plans shall be incorporated by reference in TDPs. Plans shall be prepared at the time requirements become known, utilizing the Five Year Defense Program and supporting information.

(b) AP Plans may be initiated as early as the exploratory development stage where there is a reasonable expectancy of future procurements within the dollar thresholds stated in paragraph 1-2100.2(b).

1-2100.4 *Responsibility for Preparation.*

(a) The project manager, project officer, program director, or other official responsible for the material program concerned is responsible for AP planning and for the preparation of specific AP Plans, including the concurrent updating of the Plan with each program, budget or management decision significantly affecting the Plan. This official will be supported by a project team composed of the contracting officer or his designee, and cognizant engineering, production, logistics, maintenance and other appropriate personnel.

(b) Each AP Plan shall be prepared in accordance with established milestones of the program or project. An AP Plan should be updated at least annually, beginning when the item appears in the shopping lists supporting the budget estimates submitted by the President to the Congress each January for the ensuing fiscal year.

1-2100.5 *Approval.* AP Plans shall be approved in accordance with Departmental procedures.

1-2100.6 *Support for Determinations and Findings.* AP Plans may be used to support a determination and findings (D&F) to establish the authority to negotiate a contract for supplies or services in accordance with 3-305. When requirements are reasonably firm and no delay in processing the Plan through the final approval actions is occasioned thereby, such D&F may be initiated promptly after agreement has been reached by the planning team on the complete AP Plan.

1-2101 Guidelines for Development of Advance Procurement Plans.

(a) To facilitate the attainment of procurement objectives, AP planning must identify those milestones at which decisions should be made. An appropriate time-phasing of the integral stages of the procurement must be included in the plan, identifying:

(i) the research, development, and production stages;

(ii) the points at which a determination will be made as to the type of documentation to be procured;

(iii) the time of delivery of a data package suitable for competitive procurement;

(iv) the point at which a review will be initiated to determine the practicability of obtaining competition; and

(v) when feasible and appropriate, the time when competition can be introduced either in the procurement of the overall system or by the breakout of subsystems and components for direct competitive procurement.

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A sample milestone chart is shown in 1–2102. AP Plans should also identify the performance and reliability characteristics which must be attained by the contractor and against which performance and reliability under incentive-type contracts can be accurately measured.

(b) Certain requirements, technical, and funding decisions must be made far ahead of the contracting phase of the procurement. The AP planning efforts of all personnel engaged in the busines management of the procurement process, that is, in the determination of requirements, development of a technical data package, funding, contracting, or contract administration must be coordinated. Personnel in the pre-contracting stage, as well as those involved in actual processing of the procurement request, must be cognizant of their responsibilities and participate fully in the development of AP Plans. Individually and collectively they are responsible for the extensive AP Planning and preparations necessary to achieve the procurement objectives.

(c) AP Plans shall be prepared on an individual item basis or on a project basis encompassing individual plans for one or more separate requirements under the project. For new projects or individual item requirements, the initial AP Plan will be developed and issued as concurrently as possible with the applicable TDP and shall be incorporated in a section of the TDP. When the TDP is initiated, the project manager or project officer will commence AP planning with the direct assistance of the contracting officer and the other members of the project team. AP Plans shall be prepared substantially in accordance with the sample format set forth in 1–2102, adapting it to either a project plan embracing many components, or to a single item, as appropriate. Where a project plan is utilized, the sections of the format shall be prepared, in whole or in part, for each item or class of items in the project, and one section for the integrated project itself. A complete plan would include all the goods and services to be procured. Some parts of the plan may be very detailed and some less detailed, as determined by relative complexity of procurement, but the coverage would be comprehensive. A complete project plan is considered essential to test the several parts of the project for consistency and balance, *e.g.*, to see that Government-furnished aviation equipment is procured in adequate quantity to outfit airframes being procured.

(d) The project manager (or if there is no project manager, such other official as may be designated by the Head of the Procuring activity) supported by a project team (to include cognizant engineering, production, logistics, maintenance and other appropriate personnel, and the contracting officer or his designee) will, prior to the initial procurement, consider the feasibility of direct Government purchase of components. The guidelines applicable to this determination are essentially the same as those in 1–326.4.

1–2102 Sample Format for the Preparation of Advance Procurement Plans.

(a) The following illustrative format is designed to give guidance in the preparation of AP Plans. Its use may be expanded, contracted or modified to suit the needs of individual projects or components. The greatest utility of the illustrative format would be at time of initiation of a new development.

(b) The format of the milestone chart is flexible, because the same milestones may not be present in every procurement program. For example, the contract definition stage is applicable only to selected major development

programs, and hence this milestone need not always be shown. Another example is that of equipment that has already been developed, in which case only planning for production items need be charted. Also, some equipment may never be procured competitively after the winner of the design competition, as for an airframe, has been selected. In such cases, the objective of AP Planning is to assure that equipment of the desired quality, performance and reliability is produced on time at the lowest sound price and that the contracting documents shall reflect the means for accomplishing such objectives.

(c) The first page of the sample format identifies the project by number, description, and name of project manager. Where more than one component of a project is involved, such components may be listed therein.

(d) The second page of the sample format indicates the type of narrative information which is necessary to explain the long range basis for procuring the needed items for the ensuing five-year period. It is not intended that such narrative should be compressed into a single page; the paragraphs may be expanded or contracted to fit the need. When there is more than one major component to a project, additional pages may be inserted. Plans may be tentative or firm. A tentative plan sets forth a number of possibilities from which, after investigation, a single approach is chosen on the basis of feasibility or superiority of approach. Plans may be preliminary and evolutionary in character as, for example, when the feasibility of producing an item has yet to be determined and the plan is predicated on successful determination of feasibility. Later, when feasibility has been determined, the plan may be updated in more definitive terms. The narrative should supplement the data on the milestone chart.

(e) (1) The sample milestone chart is the keystone of the AP Plan. The use of milestone charts introduces discipline into the planning process by identifying in graphic form the critical decision points that must be taken and time factors that must be observed where action is necessary to produce an item or to make a competitive buy possible. The chart not only forces consideration of all factors involved but it also provides a visual portrayal of the decisions necessary to achieve objectives and indicates the time at which they should be made. The milestone chart portrays the step by step planning and normally covers the period from feasibility study through delivery of the production items. The chart tells the story of time, cost and quantity of required items, illustrating milestones which must be recognized in the decision making process. Normally the *first milestone* is the advance development effort and the date of completion thereof. However, where there is a reasonable expectancy of future production, coupled with the need to make trade off decisions involving economic considerations, preparation of a tentative AP Plan should be undertaken prior to completion of a feasibility study. The *second milestone* usually is the award of the engineering developmental contract for purposes of design and fabrication of an item that can be service tested to prescribed design parameters. At completion of this milestone a documentation package is usually available and equipment is produced upon which

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the operational test and evaluation program is conducted. It should be noted that to this point it normally is advisable to award the work to the designer and developer. At completion of service test, the production documentation package is delivered. This package is the first technical data package upon which competition could be obtained. The *third milestone* is the first production buy (see 3–108). The developer/first producer policy is stated in 3–108. The *fourth milestone* is the second production buy. This is the milestone toward which the plan has been working from the inception of the feasibility study since it will generally indicate how future buys should be effected. At this point it should be reasonably clear whether and when competition, including price competition, is or will be feasible and practicable.

(2) This format is a tool which can be used to predict in advance potential problem areas and to measure performance in comparison to planned actions. It provides opportunity for early resolution of difficulties and elimination of late stage delays.

ILLUSTRATIVE ADVANCE PROCUREMENT PLAN FORMAT

Page ____

ADVANCE PROCUREMENT PLAN NO.

DESCRIPTION OF ITEM____________________________
PROJECT ____
PROJECT MANAGER ________________________________
(CODE AND NAME)

DESCRIPTION OF PROJECT OR ITEM

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APPROVED:

________________________________ ________
Procurement Representative *Date*

________________________________ ________
Project Manager *Date*

GENERAL PROVISIONS

ILLUSTRATIVE FORMAT

ADVANCE PROCUREMENT PLAN (NARRATIVE PORTION)

1. Item or system:
2. Program identity: (Applies to R&D only)
3. Estimated cost:

a. Current year:	Unit $________:	Total $________
b. FY 19____	Unit $________:	Total $________
c. FY 19____	Unit $________:	Total $________
d. FY 19____	Unit $________:	Total $________
e. FY 19____	Unit $________:	Total $________

4. Delivery requirements:
5. If R&D: Est. total development cost $________
6. If production: Total est. quantity and cost for remaining production life:
7. Background and Procurement History:
8. Current Procurement:
   a. Procurement method and plan:
   b. Proposed sources and basis for selection:
   c. Contemplated negotiation authority and justification: (If the Plan is to support a Secretarial D&F, include all information required by 3–302.)
   d. Type of contract contemplated and reason therefor:
9. Long Range Procurement Objective:
10. Availability of data suitable for competition: (Fully explain status and plans for acquiring and evaluating data)
11. If competition is not planned, discuss breakout in accordance with 1–326 (Schedule of Major Subcontracted Items to be attached)
12. Other considerations, when applicable:
13. Identification of members of the Planning Team:

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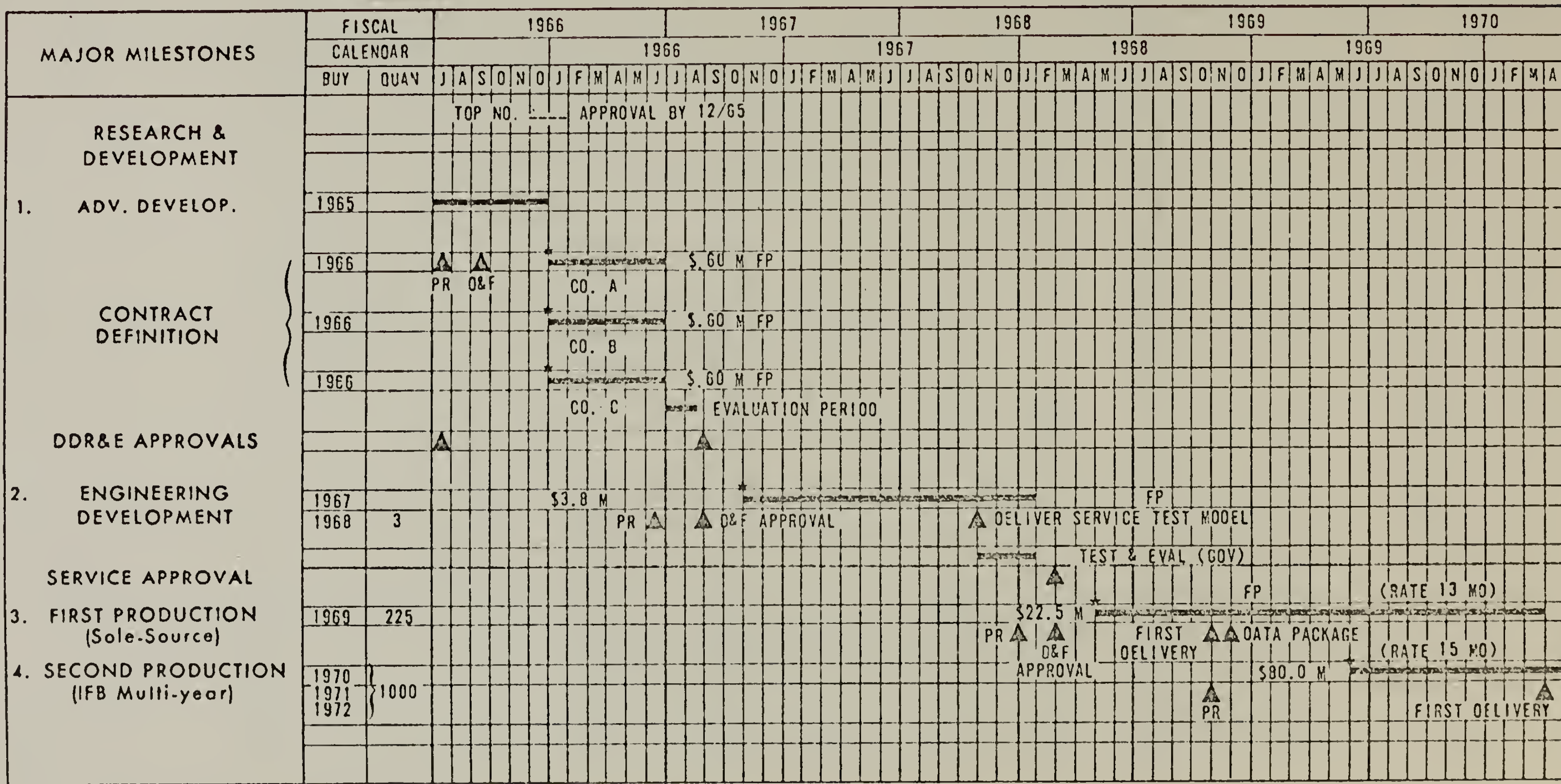
ILLUSTRATIVE FORMAT

ADVANCE PROCUREMENT PLAN NO. ___

ITEM: ______________________

PROCUREMENT PLANNING CHART



★ CONTRACT AWARD

Part 21—Advance Procurement Planning

1–2100 *Advance Procurement Planning.*

1–2100.1 *General.*

(a) The purpose of the APP is to document, at an early point in time, the long range contractual method or methods which will be utilized for the procurement by contract of both the development and production of an individual item or system. It is the written result of advance procurement planning, as defined in ASPR 1–2100.1, as the means by which the efforts of all personnel responsible for the procurement, by contract, are coordinated as early as practicable in order to obtain, on time, required items of requisite quality and at the lowest sound price.

(b) As a management tool, the APP can serve many useful functions; however, the specific purpose must remain dominant if the APP is to be used for any purpose other than that set forth in subparagraph (a) above. For example, the APP should rarely be used as sole support for a Determination and Findings (D&F), because if it is the sole support, the indication is that the APP has been delayed in submission to await specific facts required in a Request for Authority to Negotiate (RAN) or Justification for Authority to Negotiate (JAN). Use of the APP for this or any other purpose which subordinates the specific purpose of the APP to this or any other use, is not the desired advance procurement planning within the meaning of ASPR 1–2100 or this Part.

1–2100.2 *Applicability.*

(a) In addition to the requirements prescribed in ASPR 1–2100.2 for the preparation of APPs on negotiated hardware procurements, APPs will be prepared or will require coverage, in the manner prescribed in NPD 1–2101(d), for the following:

(i) Two-step formal advertised procurements. (Refer to ASPR 1–2100 (b) for dollar thresholds. In the event of a multi-year procurement, if the total estimated value of the multi-year is in the amount of $1,000,000 or more, an APP is required.)

(ii) In-house development efforts where it is anticipated that the eventual production effort will be contracted to industry and for which the production effort will require the preparation of an APP. The APP should be prepared at the commencement of the in-house effort and should show how the transition from in-house R&D will lead to production by industry.

(iii) Other procurements which the Chief of Naval Material (MAT 022) designates as requiring APP preparation.

(iv) Non-hardware procurements will be included in APPs covering system procurements under the conditions set forth in NPD 1–2101(d).

(b) Whenever emergency procurement under ASPR 3–202 is a developmental effort as a result of a Quick Reaction Capability (QRC) or Rapid Development Capability (RDC) priority, an APP is required and will be prepared as soon as possible, but is waived for an individual procurement when the preparation would delay the procurement action. A QRC, RDC or other priority assignment does not automatically waive the requirment for an APP when there will be additional requirements for an item, and an APP will be prepared and approved for these future requirements prior to their procurement.

1–2100.3 *Initiation of Advance Procurement Planning.*

(a) To initiate timely APP preparation requires that the Acquisition Manager (AM), as defined in NPD 1–2100.4(a), must notify the appropriate contract group or division and commence forming the planning council as soon as the Specified Operational Requirement (SOR) or Advanced Development Objective (ADO) is assigned to the Principal Development Activity (PDA) by the Chief of Naval Material (MAT 03). The APP must be prepared, submitted and approved in sufficient time so that it can be incorporated or referenced in the Technical Development Plan (TDP).

(b) Advance procurement planning for items which already have passed, or do not require the TDP state, shall be initiated, if the procurement meets the criteria set forth in ASPR 1–2100.2 or in NPD 1–2100.2, when a Program Change Request is initiated. The APP will be submitted no later than the time the item first appears in the Five Year Defense Plan.

(c) It is emphasized that initiation of the planning and submission of the APP should not wait until a Procurement Request (PR) has been prepared, or until funds are scheduled for obligation. Advance procurement planning and early preparation of an APP may in fact provide additional justification for the requirement of specific funding. The APP can show the optimal funding to provide the most economical contractual method and alternative contractual methods for less than optimal funding.

1–2100.4 *Responsibility for Preparation.*

(a) *Acquisition Manager (AM).* The Acquisition Manager (AM) is defined as that individual charged with overall responsibility for acquisition of weapons systems, individual items of equipment and facilities, as well as planning for logistic support of these end items. Project Managers, Project Officers, Program Directors, Commodity Managers and other officials responsible for the material program are considered Acquisition Managers for the purpose of this Part.

(1) The Acquisition Manager (AM) for the material program concerned is responsible for advance procurement planning and for the preparation of the specific APP, including the concurrent updating of the Plan with each program, budget or management decision significantly affecting the Plan.

(2) The Acquisition Manager (AM) and/or the procuring activity are encouraged to require preparation of APPs for internal use for procurements not covered by ASPR 1–2100 or this Part, even though submission to the Chief of Naval Material for approval is not required.

(b) Each organization shall make such organizational arrangements, including assignment of functions and responsibilities, as necessary to coordinate, establish and implement advance procurement planning and preparation of APPs. When the procurement of a system spans several procurement organizations, the AM shall designate the head of the APP Council who will coordinate the plans of all the organizations into preparation of an APP for the entire system.

(c) Each APP shall be updated annually. Under some circumstances, the APP may contain several years effort before a decision point will be reached that will determine future planning. In these cases, the APP may include a request that the annual update be waived. All APPs should clearly indicate when the APP will be updated.

1–2100.5 *Approval.*

(a) Advance Procurement Plans shall be prepared internally by procuring activities, signed by the Acquisition Manager and the head of contracts group or division. Ten (10) copies shall be forwarded to the Chief of Naval Material (MAT 022) for review and approval. When the designated PDA or AM utilizes the services of other activities such as Naval Ordnance Laboratories (NOLs), ONR, NADC, NTFC, NRL, or NPO (or SYSCOMS for CNM-designated PMs), the PDA or AM may either prepare the APP or designate the service activity to prepare the APP. If the service activity prepares the APP it will be submitted to the Chief of Naval Material (MAT 022), with a copy to the AM or PDA, unless the AM or PDA specifically directs submission via the AM or PDA. For those APPs sent direct to MAT 022, the AM or PDA may comment to MAT 022 within two (2) weeks of receipt of the APP copy. A review of the program will be accomplished by Headquarters, Naval Material Command and, providing it is in accordance with Defense procurement objectives and Navy policy, approval of the APP will be granted. The review of the APPs will be primarily directed towards determining the soundness of long range contractual plans in the APP.

(b) Based on the information provided and such other information which may be available, the Chief of Naval Material's approval of the APP is defined to mean, specifically, that the contractual plans set forward in the APP are judged to be sound. It is recognized that the APP is a plan, subject to unforeseen events and changes which may require deviation from the contractual plans set forth. The Chief of Naval Material (MAT 022) should however, be kept informed by either a memorandum or a revision to the APP when changes occur.

1–2101 *Guidelines for Development of Advance Procurement Plan.*

(a) The ASPR 1–2101 guidelines are flexibly outlined. Each plan must be self-supporting to the extent practical, but where necessary, references to specific parts or the whole of other documentation should be included in the APP rather than including redundant information. Referenced documents shall be made available upon request to facilitate review of the APP. If the procurement approach in the APP is supported by, of differs from, that contained in any document which has been approved at any level higher than the Chief of Naval Material, the document must be referenced and differences noted in the APP.

(b) Among the milestones, the APP should identify are:

(1) The points at which procurement of each applicable element of Integrated Logistics Support (ILS) will be started to insure timely delivery.

(2) The points at which each item of Government Furnished Material (GFM) will be available and if different, the latest date it must be available to preclude having a detrimental effect on the program.

(c) While some programs may only have several decision points, others which are more complex may have many, especially if there are several major sub-projects under one project. Though the primary concern is for procurement milestones, any other milestones or decision points which will effect the procurement should be indicated.

(d) ASPR 1–2101(d) requires preparation of APPs on an individual item basis or on a project basis, however, *a system APP will be prepared within the Department of the Navy for each complete system.* The system APP will cover:

(i) all procurements relating to the system which will require Secretarial approval of a Determination and Findings (D&F) or;

(ii) procurements that do not require Secretarial approval, but which will have a unit cost of $100,000 or a total cost of more than $1,000,000 or;

(iii) procurements by contract for studies, services, and software if Secretarial approval of a D&F will be required or total cost of the procurement will exceed $1,000,000 or;

(iv) any other procurements not covered in (i), (ii) or (iii) above, but which may have an effect on the system development/production.

In-house efforts related to the system will be discussed and the relationship shown between the effort and the system. If a subsystem is being procured under another APP, it is only necessary to reference the APP and indicate on the system APP, milestones which reflect how the acquisition effects the system procurement.

(e) The following important specific areas which have been neglected in the past will be covered in the APP:

(1) Each APP shall indicate how Government Furnished Material (GFM) or Equipment (GFE) will be procured and how it will be provided to the prime contractor in time to meet Government obligations under the contract with the prime contractor. The milestone chart may be used to show the procurement and delivery milestones in simple programs. In more complex programs, a separate milestone chart, line of balance chart, or PERT type chart may be necessary to show all procurement and delivery milestones, as well as other information on GFM or GFE. The management techniques which best indicate that the necessary advance procurement planning for all GFM/GFE has been accomplished shall be provided in the APP.

(2) Integrated Logistics Support (ILS) is necessary in all procurements. Just as it is necessary to plan the procurement of hardware for service use, it is important to procure the ILS for that hardware. Assurance shall be provided in the APP that provision has been made to procure that ILS which is necessary. If the procurement of any required element of ILS has not been provided for, the APP shall state the facts involved. An Acquisition Logistician shall be designated for each program, identified in the APP, and shall take part in APP Council meetings to insure provision is made for the procurement of required ILS. Where ILS planning has already been done in a TDP or ILS plan, such document need only be referenced in the APP.

(3) The APP shall contain a discussion of the technical risk when there is R&D to be accomplished in the program. The discussion should avoid nebulous words which are not well defined and which would convey different meanings to different persons. The discussion shall outline (i) what has been accomplished to eliminate risk, (ii) the results of testing that took place, and (iii) a comparison of these test results with the goals established for the item or program at its inception. When no test results are available, the comparison may be made to similar programs which had similar developments in the past. When the terms high, medium, low, or no risk are used, an explanation as to how this determination was made shall be included. It may be sufficient to reference specific parts of an approved TDP.

(f) Whenever Advance Procurement Plans do not schedule the introduction of competition for the end item, the following information concerning breakout shall be included in such plans:

(i) a statement that ASPR 1-326 is being complied with;

(ii) identification of components for which a decision to breakout has been made, and brief discussion of acceptability of risks and estimated overall cost savings;

(iii) with respect to those components which have been reviewed and earmarked as being susceptible to breakout pursuant to ASPR 1-326.3, the number of items included thereunder shall be indicated and identified if their number is sufficiently small to do so without imposing an excessive administrative burden, briefly stating the reason why such components are not now subject to an affirmative decision to breakout;

(iv) if the listing of the components under (iii) above will impose an excessive administrative burden, the Advance Procurement Plan shall state that the documentation required by ASPR 1-326.5 has been prepared and will be available for review by representatives of the Chief of Naval Material. Such documentation will be reviewed by the Chief of Naval Material on a selective test basis;

(v) identification of components of systems and subsystems not susceptible to breakout shall not be made in the APP but a listing thereof, and a brief statement as to the reasons for their nonsusceptibility, shall be maintained on file in the procuring activity subject to review by the Chief of Naval Material.

1–2101.1 *Establishment of Cut-Off Dates.* Advance procurement planning is a continuing process. The APP only represents the plans at a single point in the process. To allow for an orderly processing, the Acquisition Manager shall establish a cut-off date and the APP shall be prepared and submitted with the information available as of that date. The APP need not be redrafted if changes that occur prior to the date of submission to the Chief of Naval Material (MAT 022) do not effect the contractual method(s) to be used. A memorandum shall be attached to the APP indicating the changes that have occurred.

1–2101.2 *Classification of APPs.* Because of their planning nature, APPs which do not contain classified information shall be marked "For Official Use Only" and be handled and safeguarded as required for documents so marked.

1–2101.3 *Execution of Advance Procurement Plans.* Where circumstances dictate, procuring activities may proceed with the execution of the plan, pending its approval, up to the point of issuance of Request for Proposals or Quotations.

ENCLOSURE 4

NAVORD ADVANCE PROCUREMENT PLAN NO. 0XX-XX-71.X

PROGRAM: Surface Navy Launched Multi-Purpose Missile (SUN-LAMP)

PROJECT MANAGER: LT. B. R. LEONARD (PMO-100)

DESCRIPTION OF PROGRAM

The purpose of the SUNLAMP Program is to provide the operating forces with a light weight antiship to be installed on small combatants (PGH VIPER/DD/PF).

The program is to modify and test a guidance system and procure a launcher and interface it with an in-use USN ship-board weapon direction system together with support equip-ments, maintenance package and logistics plan. The program shall investigate the possibilities of (1) upgrading the present SEAHAWK system, (2) building a multi-purpose system from existing USN/USAF/USA/USMC hardware and technology, and (3) building a multi-purpose system from NATO navy components.

APPROVED: ______________________________ ____________
DEPUTY COMMANDER FOR CONTRACTS DATE

______________________________ ____________
PROJECT MANAGER DATE

Plan prepared by B.R. Leonard, questions should be referred to this planner (the cut-off date for information delineated in this APP is 2/4/72)

NAVORD ADVANCE PROCUREMENT PLAN NO. 0XX-XX-71.X

1. System:

The SUNLAMP Program is comprised of subsystems identified as follows:

A. STARFIRE Missile

B. GFCS MK 86

C. Missile Guidance/Control Package

D. Launcher Package

The equipment items under each of the respective subsystems are described in Attachment #1, hereto. The alpha-numeric numbering system used to identify each of these items will be utilized throughout this APP for brevity purposes and for cross reference to SUNLAMP Program documentation.

2. PROGRAM IDENTIFY:

GOR	11-71
TSOR	11-72
SOR	11-72
PTA	#678-ORD
RDT&E	Element No. 28263X
FY 73	Apport. Req./POM 73 (addendum) Nov. 71

3. ESTIMATED COSTS:

FISCAL YEAR	R&D	PRODUCTION	SUPPORT
73	3,000K	10,000K	2,000K
74	6,000K	30,000K	3,000K
75	7,000K	85,000K	8,000K
76	4,000K	40,000K	5,000K
77	1,000K	15,000K	2,000K

4. Delivery Requirements Based on Production Schedule of new ship and ROH of ships to be retrofitted:

	FY 74	FY 75	FY 76	FY 77
NEW CONSTRUCTION				
PGB VIPER CLASS	0	4	10	11
PF CLASS	0	12	12	6
OTHER APPLICATIONS				
I&E TRAINING	3	2	0	0

CPSS dates for equipment for installation on new construction is as follows:

a. Foundations, base and other structural items requiring attachment and alignment to the hull will be scheduled for delivery 12 months prior to completion of ship construction.

b. Other equipment will be scheduled for delivery a minimum of 9 months prior to completion of ship construction.

c. Test equipment and associated support equipment will be scheduled for delivery 6 months prior to completion of ship construction.

CPSS dates for equipment for installation during regular overhauls is as follows:

All equipment and hardware - 6 months prior to beginning of overhaul.

Ship Types Requiring SUNLAMP Systems:

PGH	(2)	FY 74	FY 75	FY 76	FY 77
PGH	(2)	0	4	10	11
PF	(30)	0	12	12	6
Other Appl.	(5)	3	2	0	0

5. ESTIMATED TOTAL DEVELOPMENT COST:

Approximately 21,000K through FY 77

6. TOTAL ESTIMATED COST FOR PRODUCTION:

Approximately 200,000K through FY 77

7. BACKGROUND AND PROCUREMENT HISTORY:

a. Background:

Most systems presently installed in the fleet have been designed from their inception as one separate weapon system to be used for specific purposes. While this type of development is capable of producing an ideal system for a particular application, it also produces very high cost due to state-of-the-art development costs. In the face of other pressing national needs the funding for new and expensive systems has become most austere. However, the need for new weapon systems to insure the security of our nation continues to grow.

One solution to our need for new weapon systems is to provide adequate, but quite possibly less than ideal, weapon systems by adapting and modifying existing weapon system components to meet the defense needs. While satisfying an operational need, funds that might otherwise be used on extensive development of one project are released for development of other systems.

The SUNLAMP Project is such a "hybrid" system. By making maximum use of the U.S. Army's operational surface to surface missile, the STARFIRE, by utilizing the Navy's GUNFIRE CONTROL SYSTEM MK 86, and by NAVORDSYSCOM intergrating the system components the development cost of the new system will be kept to a minimum. The savings realized by using currently produced and supported equipment will greatly aid in keeping the total development cost of SUNLAMP low.

b. <u>Prior Procurement Activities:</u>

Due to the "hybrid" nature of SUNLAMP, some major components are "off the shelf." The Army, which plans to cut back on the number of deployed STARFIRE Missile batteries in FY 75, can release up to 75 STARFIRE Missiles from their stockpile. Therefore, the development and production of additional missiles is not required at this time. Lockheed Missile and Space Company, Sunnyvale, built and delivered 375 STARFIRE Missiles and guidance systems to the Army from FY 69 to FY 71.

The Navy has proprietary rights to the specifications to the MK 86 Gunfire Control Systems. "Off the shelf" components will satisfy the FY 74 requirements and sole source or competitive procurement can provide the additional requirements. While it's anticipated that some modifications will have to be made to the STARFIRE Missile guidance package and to the MK 86 GFCS to make it compatible with the SUNLAMP system, NAVORD engineers are confident that the modifications are within state-of-the-art. They also believe that the modifications to the missile guidance package are well within the capability of Lockheed Missile and Space Company (LMSC), the prime contractor for the original STARFIRE missile system.

8. CURRENT PROCUREMENTS:

a. Procurement Method and Plans:

It is planned to award the contract for the production of the launcher and the modification of the guidance package and gunfire control system during FY 72. It is planned to use the following procurement method:

1. Incentive Provisions: The requirement for quality and quantity of systems is firm. Performance, reliability and quality requirements have been established. Maintenance, logistics, and test and evaluation requirements will be established. Scientific analysis is virtually complete and technical problems can be isolated. Equipment design is within the state-of-the-art. All major design is considered stable with minor launcher, and interface requirements still remaining to be defined. Producibility risk has been assessed. It is considered that the cost of structuring and administering an incentive is more than offset by the potential cost savings. Utilization of performance and delivery incentives are not planned.

b. Proposed Sources and Basis for Selection: LMSC is proposed as sole source for modifying the missile guidance package section of the system. LMSC built the STARFIRE Missile in FY 69 through 71. Raytheon is proposed as sole source for the MK 86 GFCS. Raytheon has been building the MK 86 GFCS for the Navy and is currently under contract to provide MK 86 GFCS for 30 of the 60 planned SUNLAMP installations. Lockheed as the prime contractor for the STARFIRE Missile system and Raytheon as the prime contractor

for the MK 86 GFCS have the technology base, facilities and demonstrated experience that can provide these major components of the SUNLAMP system at least cost to the Navy. Negotiations between Hydraulic Specialist Inc. and Huggs Tool Co. are recommended for the purchase of the Launcher. Hydraulic Specialist currently manufactures the ASROC Missile Launcher while Huggs Tool Co. currently produces the Sea Hawk Launcher. Both of these firms have the existing technical base, production capability and experience to produce the SUNLAMP Launcher within the production/delivery schedule time constraints. System intergration will be performed by NAVORDSYSCOM.

c. Contemplated Negotiation Authority and Justification:

(1) Launcher and interface engineering for development and production: 10 USC (a) (10) is considered the authority for negotiation. A sole source negotiated contract can be justified because LMSC was the prime contractor for the STARFIRE Missile and guidance system which will be modified for SUNLAMP and, therefore, is uniquely qualified to develop and produce the modified guidance package for the SUNLAMP system. Raytheon is likely uniquely qualified to produce the MK 86 GFCS for the additional 30 installations.

d. Type of Contract Contemplated and Reasons Therefore:

A fixed Price Incentive contract is planned. Because the two major expense items in this contract, the missile and GDCS, are GFM, the primary risk of cost overrun is confined to the modification of the missile guidance package and to the development of the launcher. At the same time, there is

a cost reduction possibility attributed to the contractor's potential ability to coordinate the development and production efficiently. It is conviently anticipated that a realistic target price, cost ceiling and share ratio can be negotiated. Delivery and performance incentives are not planned to be used.

9. LONG RANGE PROCUREMENT OBJECTIVES

Subsequent to the production of the SUNLAMP system, additional requirements for a multi-purpose ship launched missile system may be required. LMSC and Raytheon will not have proprietary rights to documentations on the SUNLAMP system. Unless state-of-the-art modifications are required on a follow-up procurement of SUNLAMP systems, formal advertising may be appropriate. GFCS to fill FY 75 and 76 requirements will be procured.

Contemplated SUNLAMP requirements for FY 73 and beyond are discussed on Figure (2).

10. AVAILABILITY OF DATA FOR COMPLETION

a. In as much as Lockheed Corporation has retained the machine tooling, test instruments and facilities and design data incident to the development and production of the STARFIRE Missile this section is not definitively applicable.

b. It is envisioned that considerable cost savings to the government will be effected by NAVORDSYSCOM coordinating the components for the SUNLAMP system. Due to the concept of integrating currently available components it is currently

estimated that SUNLAMP development costs will be less than ten percent of production costs based on the production base of 60 units.

11. BREAKOUT

Not applicable

12. OTHER CONSIDERATIONS

a. Sole Source Board Approval

Current procurement of GFCS and Guidance package will be presented to the NAVORD Sole Source Board for review and approval upon completion of the P.R.

b. Small Business

It was determined by the Project Manager that no procurements would specify small business; however, small business organizations will be considered on all formally advertised procurements.

c. Integrated Logistic Support (ILS)

(1) General

The primary objective of the Integrated Logistics Support Management program is to provide for systematic planning, acquisition and management of total logistic resources in order to obtain maximum material readiness and optimum cost effectiveness of the SUNLAMP Weapon System.

Necessary and sufficient logistic support and technical assistance will be procured to provide for operation, maintenance and support of SUNLAMP equipment by personnel of the U.S. Navy. Additionally, every effort will be made to

maximize use of common support systems, procedures and facilities, integrating them with the peculiar requirements attributable to SUNLAMP wherever possible.

(2) Current Procurement

Provision will be made for the coordinated and systematic planning, design, acquisition, distribution, and management of the following major elements of logistic support as an integrated whole:

a. Planned maintenance

b. Support Personnel Requirements and Training

c. Publications

d. Support Equipment

e. Spares and Repair Parts

f. Facilities

g. Contractor Technical Services

as related to the planned procurements indicated in paragraph Eight of this document.

Maintainability design will be accomplished with full consideration to the operational environments in which SUNLAMP will operate. Features and characteristics of new equipment design will be such that maintenance can be accomplished by military personnel under the operational conditions in which the equipment will be operated and maintained.

A Failure Data Program will be employed. The intent of this program is to provide a data base for predictions and analysis during the design and development phase

and provide feedback during equipment and system testing in order to identify potential problem areas and implement any necessary corrective action. The data system complies with the requirements of MIL-STD 470 and MIL-STD 785A. Initially patterned after Navy data system techniques, it has been modified periodically as the Navy 3M system has evolved, maintaining similarity of concept.

Data from the data systems will be processed using IBM 360/75 computer facilities, thus allowing for effective and efficient retrieval of reliability, maintainability and support data. This data will be made available in both summary and detail form for distribution to groups responsible for problem analysis and corrective action.

(3) Long Range Procurement

Specific requirements directly related to Integrated Logistic Support of follow-on procurements of the SUNLAMP Weapon System will be addressed as plans for procurement of additional systems are formulated. Policies for the integration of the elements of logistic support during the Contract Definition Phase and Development Phase will be revised where necessary to reflect current thinking and planned procurements.

APPENDIX B

DCP/DSARC CASE

A. BRIEF

This case investigates the roles of the Development Concept Paper (DCP) and the Defense System Acquisition Review Council (DSARC) in the procurement life cycle of a major weapons system. The current DCP/DSARC process as formally stated in DOD Directive 5000.1 of July 13, 1971 is reviewed and analyzed. The DCP/DSARC process applicable to the Patrol Frigate (PF) is presented, and the unique problems associated with conventional hull ship acquisition programs are discussed. Alternative proposals to the present DCP/DSARC process are considered. The student is required to prepare an outline for a DCP and a DSARC presentation.

B. OBJECTIVES

During investigation of this case the student will develop an understanding of:

1. The purpose of the Development Concept Paper.
2. The purpose of Defense Systems Acquisition Review Council.
3. The implications of Research and Development (R&D) projects versus non-R&D projects in the DSARC process.
4. The unique problems associated with the management of conventional hull ship acquisition projects.
5. Alternative approaches to the present DOD level review system.
6. The CNO's thoughts and proposals for carrying out a simplification of the DCP/DSARC requirements for ship acquisition.

C. BACKGROUND

During the life cycle of a major system, there are a few occasions when requirements, plans, and approval come together for formal service and Office of the Secretary of Defense (OSD) interface. These critical occasions or stages and the process for Department of Defense (DOD) approval of these stages in systems acquisition process are formally stated in DOD Directive 5000.1 of July 13, 1971 entitled "Acquisition of Major Defense Systems." According to this directive the Secretary of Defense (SecDef) will make the decisions which initiate program commitments or increase those commitments. Currently, the SecDef makes three key system decisions by choosing among alternatives posed in the Development Concept Paper (DCP) and in updated versions of this document. He also obtains the recommendations of the Defense Systems Acquisition Review Council (DSARC) to assist him in making his decision. The specification of the three distinct stages in the systems acquisition process with DOD level review between stages is designed to minimize concurrency and commitment of full-scale development and production before adequate information is available and analyzed.

The DCP is the primary development program management document in OSD. It summarizes the essential arguments which the SecDef must consider in arriving at his decisions whether to continue the program and, if continued, in what form and

with what restraints. The considerations which support the determination of the need for a system program, together with a plan for that program, are documented in the DCP. The DCP defines program issues, including special logistic or procurement problems, program objectives, program plans, performance parameters, areas of major risk, system alternatives and acquisition strategy. The document is prepared by the Service and coordinated among all interested parties in the Services and OSD by the Office of the Director of Defense Research and Engineering (ODDR&E).

The DCP approved by the SecDef will identify the limits or conditions that accompany his decision. These are the thresholds or limits of cost, schedule, and performance which cannot be changed or violated without SecDef approval. These thresholds require the Service to initiate a later SecDef program review if the limits are likely to be exceeded.

The DSARC, which is the vehicle for OSD's review of the program being recommended by the Service, provides a major input to the Secretary. A typical pre-DSARC schedule of events is presented in Figure 1. The DSARC is composed of the Director of Defense Research and Engineering, the Assistant Secretary of Defense (Installations and Logistics), Assistant Secretary of Defense (Comptroller), and the Assistant Secretary of Defense (Systems Analysis). Also, the Deputy SecDef may attend these meetings.

A flow chart of the DCP/DSARC system as outlined in DOD Directive 5000.1 is presented in Figure 2.

The currently required DCP and DSARC schedules are as follows:

1. Approved DCP - following Exploratory Development.

2. DSARC I - Program decision to proceed from Exploratory Development to Advanced Development.

3. DSARC II - Program decision to proceed from Advanced Development to Engineering Development.

4. DSARC III - Program decision to proceed from Engineering Development into Production.

Typical Pre-DSARC Schedule

Event	Time
Completion of draft DCP staffing in OPNAV	3 months prior to DSARC*
Preview of CEB addressal of program	2 1/2 months prior to DSARC**
CEB for OPNAV review of program	2 months prior to DSARC***
DCP forwarded to SECNAV	1-2 weeks after CEB
CNO and SECNAV informal meeting on program issues (as required by SECNAV)	--
[Exchange of "For Comment" and "For Coordination" versions of DCP between Navy and OSD]	
Copy of DSARC presentations provided to Op-96	2 days prior to Flag Level Review
Flag Level Review of DSARC presentations	2 weeks prior to DSARC
Final version of DCP forwarded to OSD	2 weeks prior to DSARC
Independent Parametric Cost Estimate Presentation to CAIG	2 weeks prior to DSARC
Joint CNO and SECNAV Review of DSARC presentations	1 week prior to DSARC

* 4 months for new programs.

From OPNAVINST 5000.41A
18 Dec 1972

** 3 1/2 months for new programs

*** 3 months for new programs

Figure 1

DCP/DSARC

DOD 5000.1

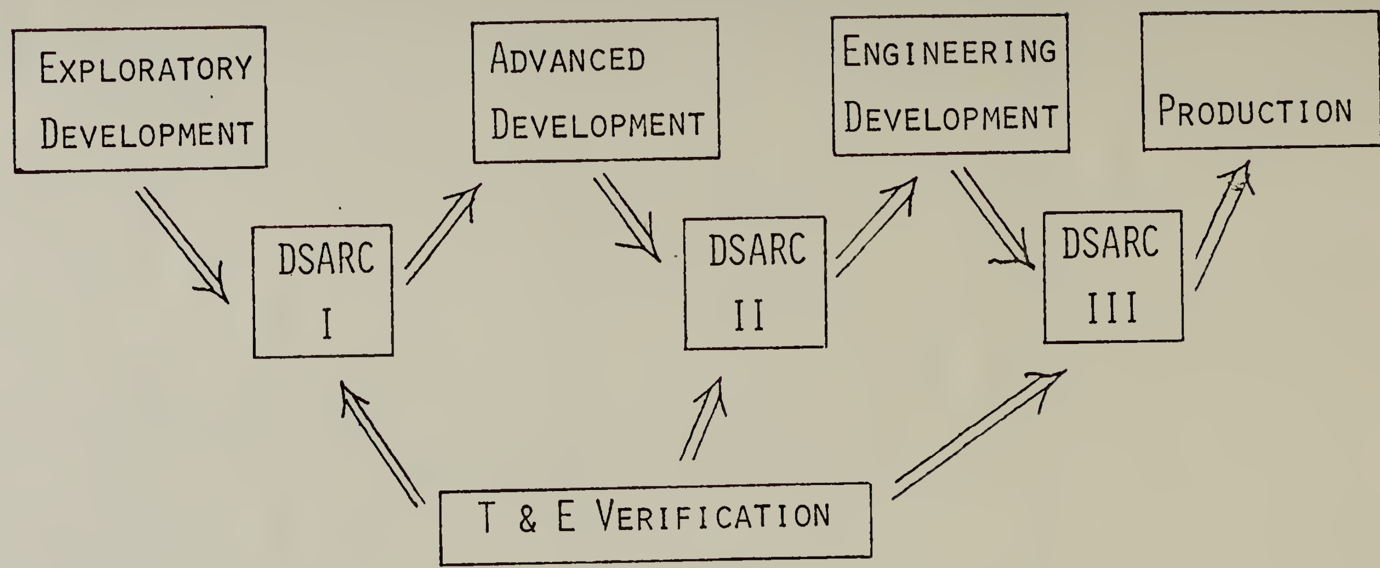


FIGURE 2

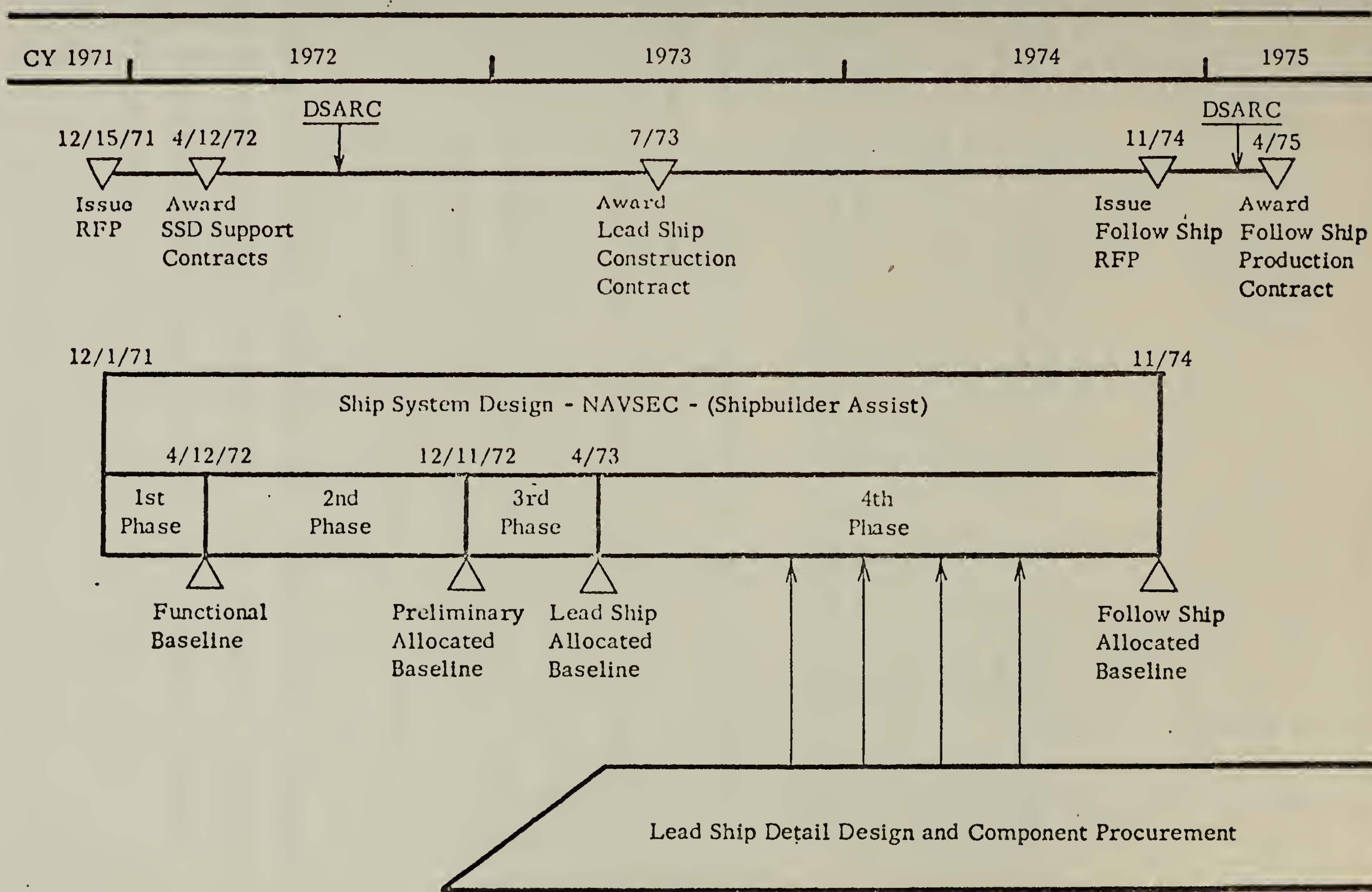
D. THE DCP/DSARC PROCESS FOR THE PATROL FRIGATE PROGRAM

A schedule of the DCP/DSARC process for the Patrol Frigate program is shown in Figure 3. The preparation of the PF DCP was a joint effort between the Navy and DDR&E with the Navy having prime responsibility for presenting the justification and procedures for the acquisition of the system.

The Navy's responsibility was further subdivided so that OP-03D primarily prepared the analysis for justification of the system and the project staff (PMS 399) prepared the plans and procedures for the acquisition. This split developed because of the high degree of centralization of decisions at the CNO and OPNAV level in this project. The CNO personally established cost, time, manning and tonnage limitations and many of the characteristics of the ship, such as the propulsion system, sonar suite, and number of helicopters.

The first DSARC had been established as early as 1971 in early PF documents. However, in February 1972 the meeting had not yet occurred. The DCP, although limited to 20 pages plus tables, then consisted of about 50 pages plus several pages of negative comments from the DDR&E. These comments chiefly questioned the justification for the ship as presented and the degree of concurrency in development and production. At that time the justification consisted in

FIGURE 3
PATROL FRIGATE SCHEDULE



brief form as:

1. A statement that the present escort force is old and rapidly being phased out of the fleet. A description of the threat in terms of bombers, missiles and submarines.

2. An escort with anti-air warfare (AAW) and anti-ship missile defense (ASMD) characteristics would be effective in protecting convoys from fighter-bombers and ASM's in small numbers. Plots of percent destroyed of these attacking forces versus a number of PF's protecting a convoy were shown.

3. A discussion of each major subsystem on the ship and its performance characteristics. For some of these subsystems the PF concept exploration report (CER) was referenced since subsystem selection trade-offs had been addressed at that stage. For example, the best sonar had been rejected in that study because of its cost, space and weight requirements and the fact that the PF was envisioned to be in convoy with other escorts which would be equipped with the best sonar. A memo from PMS 302 to PMS 399 discussing the sonar requirements is presented in Enclosure 1. The helicopters would also be sonar-equipped. In general, however, the subsystems were presented as "best for the mission."

A schedule of the procurement plan and the types of contracts is also shown in Figure 3.

The contracts for ship design support were awarded on April 12, 1972. Meantime a meeting of the CNO's executive board (CEB) was scheduled for May 18 to review for the DSARC. At this point the DCP had been revised particularly with respect to the justification. The gun, sonar, number of helicopters, number of computers, manning level and use of automatic detection and tracking had changed since February. The justification now presented the JSOP levels of number of escorts in the required objective, and "reasonably obtainable" forces, each of which is a mere fraction of the preceding.

The discrepancy between "reasonably obtainable" and the post World War II escort forces available still would not be filled by the PF program level. The AAW and ASMD roles were emphasized and the ASW role de-emphasized as well as performance of the helicopter. Many of the subsystems were justified in their selection by their lower cost and weight.

About the middle of May one of the project staff made the following remark in conversation.

> "The DCP is the means for everyone, both Navy and DOD, in the R&D effort to get their noses into the ship design effort. As long as the DCP is not approved they can keep trying to sell their pet programs. Once it's approved they'll have to stop. I'll bet there won't be an approved DCP until after the award of the production contracts for follow-on ships."

E. ALTERNATIVE PROPOSALS

Several Admirals and Program Managers in OPNAV and SHIPSYSCOM objected to the use of the three step DCP/DSARC procedures for conventional ship construction programs. They felt that the current DCP/DSARC was structured to provide proper management for major Research and Development programs and that the highly controlled and definitive system was, in many ways, inappropriate for the management of a conventional ship acquisition program. They said the rigid application of this procedure to conventional displacement hull ship programs would result in unnecessary expenditure of time by project personnel, increased expense, and delays in delivery of urgently needed ships to the fleet. It was recommended that the first essential step required to alleviate this problem was to separate non-R&D programs, such as shipbuilding, from

the R&D programs that do require the "fine grained" management review and test and evaluation now being proposed for all programs. A flow chart of a proposed modification to the DCP/DSARC process applicable to conventional displacement hull shipbuilding programs is presented in Figure 4.

The Chief of Naval Operations (CNO) after studying the problem believed that a streamline of the decision processes used in ship acquisitions was in order. The following memorandum to the Secretary of the Navy was prepared by the CNO and sets forth his thoughts and a proposal to carry out a simplification of the DCP/DSARC requirements for ships:

> "The current DCP/DSARC procedures were developed to insure proper management of all new major programs. The basic structure of the DCP/DSARC is well suited to programs covering research, development and procurement of new weapons systems and equipments. There are, however, many factors in conventional ship construction programs which are different from normal research and development programs and detailed compliance with the DCP and three stage DSARC procedures unduly complicates getting our shipbuilding programs underway.
>
> The purpose of the DCP system is to produce a document that will provide essential technical and operational programmatic information to the SecDef prior to all of his decisions concerning major defense programs. It is designed to identify the primary issues and differences in the basic data on assumptions; set forth the principle program features, alternatives, military and economic rationale and risks; provide the means for insuring collaboration and debate by key DOD officials; record and set forth the SecDef program decision and its rationale and define the manner in which the program is to proceed.
>
> As stated this system is well suited for emerging research and development programs; however, it is overly complex and restrictive when applied rigorously to the majority of our shipbuilding programs. Also, as with all management systems, the DCP requirements have tended to grow, requiring ever more lower level detail information thus further contributing to complexity, overmanagement and delay in carrying out our urgently needed fleet modernization.

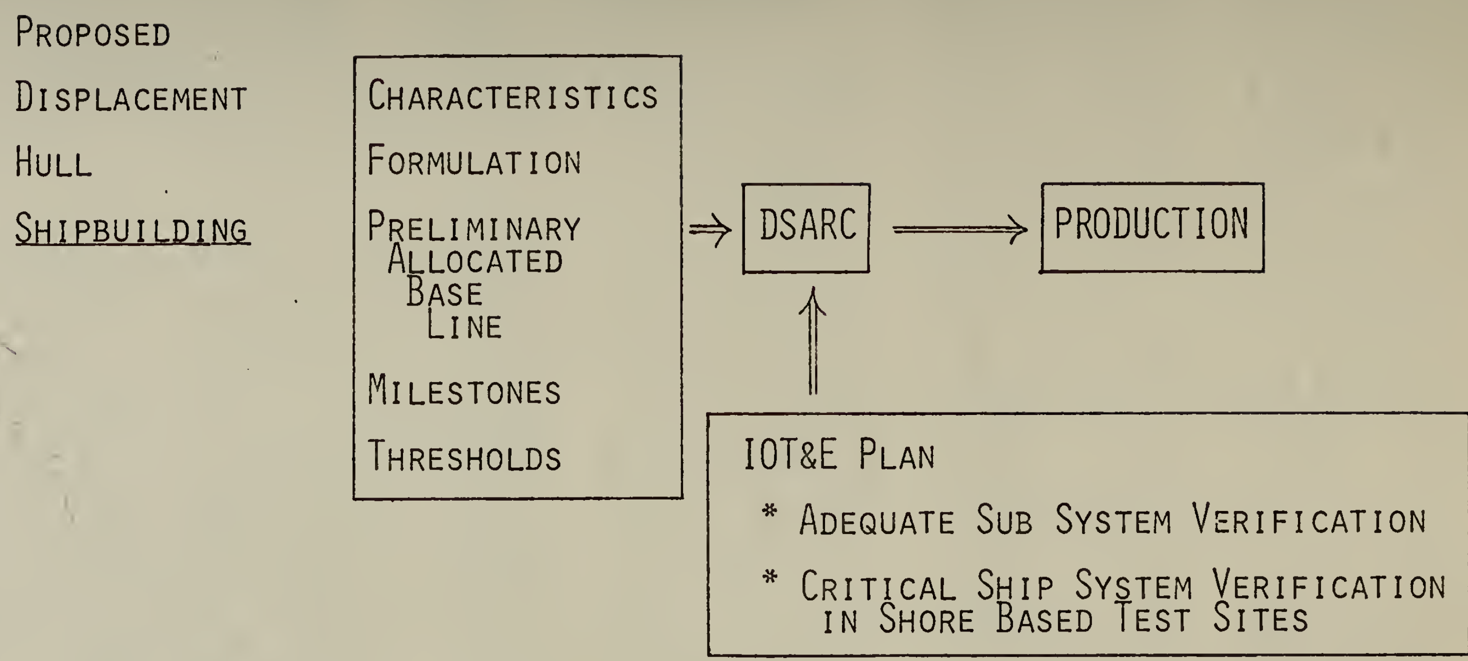

PROPOSED
DISPLACEMENT
HULL
SHIPBUILDING
CHARACTERISTICS
FORMULATION
PRELIMINARY ALLOCATED BASE LINE
MILESTONES
THRESHOLDS
DSARC
PRODUCTION
IOT&E PLAN
* ADEQUATE SUB SYSTEM VERIFICATION
* CRITICAL SHIP SYSTEM VERIFICATION IN SHORE BASED TEST SITES

FIGURE 4

There are, obviously, some ship programs which require extensive research and development. New technology hulls would be in such a category, if they were not being developed in prototypes. For such programs, the full definitive DCP process is required since it is mandatory that the feasibility and applicability of this type platform be adequately demonstrated before embarking on a program for fleet introduction and use. In general however, most of our ship programs do not fall into this category.

The required Navy force levels are established through the approved OSD, JCS, Navy processes and the status of our existing assets are well known. It is also economically impossible to build ships in the numbers needed to have all of our required forces as new and modern as requirements dictate. Thus, our shipbuilding programs in the main are required to provide replacements for obsolete or overage units and to attempt to meet the minimum required force levels.

There is little question, therefore, as to the need for building these conventional ships, and their missions and requirements have been well established time and again. Thus, it should not be necessary to justify in elaborate detail in each DCP why this type of ship is required, and what mission it is to fulfill. Likewise, the many varied threats which the fleet must face are well known to all appropriate offices within the Department of Defense and to relate this in ship DCPs is redundant.

There is a requirement, however, for the Navy to demonstrate that a proposed ship program provides a cost effective solution to the problem of maintaining our force levels with modern effective ships.

There is another area where the DCP process is now generating problems in ship programs. This concerns the determination of ship characteristics. Unlike research and development programs, there is no total ship R&D in conventional displacement hull ships. We know that the ship will float, make the defined speed and have the requisite endurance. We have years of experience on which to base these predictions and our performance in past programs verifies this fact. The primary point, then, is the adequacy of weapons, sensors and other related systems called out in the characteristics. It is necessary that, during the ship formulation process, adequate analyses and studies be made to develop the system alternatives and to enable selection of specific equipments. As in any complex problem, there have to be compromises and trade-offs between the several systems and capabilities. Often they are supported by analyses, but some of the decisions must be made on the basis of judgment and experience. The CNO makes such decisions based on the best technical advice within

the Navy and in consideration of the program goals and constraints.

It is essential that the available analytical support data be furnished to the OSD. The OSD staff should insure that the parameters of the various systems are realistic and that the production risks are properly identified and addressed in the overall program plan. However, the Navy should not be subject to time consuming and repeated justification of the choices made. Obviously, every selection can be questioned and in a balanced well thought out and cost effective ship not every system will have maximum effectiveness. The CNO approved characteristics have considered these facts along with the Navy's overall force requirements and the fiscal constraints. Unless there is a significant mistake or over statement of system capabilities or parameters, or an understatement of production or schedule risk, the approved characteristics selection should not be subject to detailed system by system review and challenge.

The DCP and DSARC review should rightly consider in detail the program cost predictions, contracting and production methods, IOT&E provisions, schedules and thresholds. The program management and progress monitoring provisions are also most important and should be thoroughly covered as should be the contractors' ability to produce.

The three DSARCs and their decisions are again geared to the normal structuring of a research and development program. Conventional ship programs do not fit this general DSARC schedule. For example, once the ship formulation and resultant characteristic determination have been accomplished, ship system design proceeds rapidly either in-house or in-house with shipbuilder participation by the selected shipbuilder. In either case, the ship program should be in the current budget in order not to have an additional year's delay in beginning ship construction. It would, therefore, appear proper to have only one DSARC in a ship development program conducted after completion of formulation and ship systems design, and prior to contracting for the detailed design and production of the lead ship.

If significant milestones, including those for IOT&E, are satisfactorily met no additional OSD formal reviews are required. It may be necessary to validate the satisfactory completion of IOT&E or other program milestones by means of a formal management review at a time in the program as specified in the DCP. Also, management reviews should be held when major program thresholds are broached.

It is, therefore, proposed that the DCP system for ships be modified in concept over that utilized for major weapons systems. In accordance with the above philosophy, the DCP should provide:

a. Statement of mission and requirement for proposed ship and program.

b. Discussion of rationale of decision leading to the defined ship and program. (Footnote applicable analysis for reference and study).

c. Required ship characteristics (Footnote applicable analysis and technical performance criteria for reference and study.)

d. Technical and schedule risk analysis and milestones.

e. Procurement plan.

f. IOT&E plan.

g. Major issues and alternatives.

h. Program thresholds.

One DSARC should provide for program approval and construction of the first ship. Additional formal OSD management reviews would be held when required, either to validate the IOT&E requirements or whenever major problems arise or established thresholds are breached."

In summary the CNO proposed policy for displacement hull ship program includes: (1) one DSARC per ship program to be conducted after completion of formulation and ship system design, but prior to contracting for detailed design and production, (2) demonstration of adequate IOT&E performance for sub-systems prior to large scale production, (3) the use of shore based test sites for critical ship system integration demonstration, and (4) elimination of additional DOD formal reviews if all significant milestones are satisfactorily met, including those for IOT&E.

The DCP for the PF was approved with a few modifications, and on 31 August 1972 the Patrol Frigate Project Manager presented the PF acquisition program to the Defense Systems Acquisition Review Council. The following topics were discussed in the DSARC presentation: (1) Ship Design Features, (2) Procurement Plan, (3) Test and Evaluation, (4) Production Plan, (5) Program Cost, (6) Program Risks, and (7) Recommended Thresholds. Deputy Secretary of Defense Rush's response to DSARC I is presented in Enclosure 2. He authorized the Navy to proceed with the program for development and construction of the PF lead ship and land based test sites. He requested that an informal review of program test results and contract plans be conducted 120 days in advance of a proposed DSARC III. The Navy was also requested to develop a plan for, and evaluate the impact of assigning the lead PF to OPTEVFOR for a reasonable period to complete an at-sea operational appraisal of the PF as a whole prior to the lead ship's full release for Fleet usage.

F. DISCUSSION QUESTIONS

1. Should the DCP/DSARC process as stated in DOD Directive 5000.1 be applicable to conventional hull ship acquisition programs? Why or why not?

2. How many DSARC decision points should be required in a conventional hull-ship acquisition program? Where are the critical decision points in this type of acquisition program?

3. Should the DCP/DSARC decision-making be required at the SEC DEF level or is the Service head or Service Secretary level sufficient?

4. If you were the PF SHAPM:

a. When would you want your next DSARC?

b. What topics would you present?

c. What decisions and thresholds should be addressed?

d. What fall-back positions should be developed in case of a negative DSARC decision?

e. What would your response be to the PMS 302 memo?

G. REQUIREMENTS

Each student will develop an outline for a PF DCP and a PF DSARC I presentation. The student's position on the issues mentioned in the discussion questions should be addressed in these outlines.

MEMORANDUM

PMS302-21:AOB:ap
Ser: 7-PMS302-21

FROM: PMS-302

TO PMS-399

SUBJ Patrol Frigate Sonar

REF (a) PMS-399 Memo Ser 292 of 3 July 1972
(b) NAVSHIPS ltr Ser 0121-PMS386 of 12 June 1972
(c) SECNAV INST 5000.1 of 13 March 1972
(d) ASPR 6-103.5, NPD 6-103.2 and the Buy American Act (41 U.S.C. 10a-d)
(e) NAVSHIPS Note 4120 of 12 January 1971
(f) GOR-22 Surface ASW

ENCL (1) Attributes of DE 1160 and SOS-505 Sonars
(2) Space and power requirements for the AN/SOS-38 and DE 1160 Sonars

1. In reference (a), PMS-399 requested PMS-302 to initiate action, at the earliest possible date consistent with funds availability, for procurement of one SOS-505 sonar system from Canadian Westinghouse Limited for installation on the lead PF.

2. In light of reference (b) and numerous other factors, listed in enclosure (1), and addressed in paragraph 6 below, PMS-302 considers this selection of the SOS-505 detrimental to the US Navy surface ship sonar program and contrary to the letter and spirit of references (c) and (d).

3. To date, no Specific Operational Requirement (SOR) has been addressed to a small, surface-duct sonar comparable to the SOS-505 for installation on US Navy ships. The only requirements for such a system are spoken to in PF characteristics memoranda and decision papers. These requirements are stated in such general terms as "SOS-505 type," "small," "solid-state," "duct-sonar," "of a cost less than the SOS-505," etc.

4. Based on information available and the guidance of references (c), (e) and (f), PMS-302 infers that the PF sonar must possess the following attributes:

a. Capability to detect, localize with sufficient accuracy to permit a fire control solution adequate for over-the-side torpedo attack, and classify submarines outside the submarines' effective torpedo range.

b. Minimum skilled manpower requirements.

c. Cost-effective miniturization and automation.

d. Multi-function capability.

e. Compatibility with digital Command and Control and Fire Control systems.

f. High reliability, availability, and maintainability.

g. Be an on-the-shelf item which is at the upper end of the development spectrum of technology.

h. Have interface data with other PF ship's systems fully defined by 1 October 1972.

i. Have full installation data for follow ship contract baseline by 1 October 1974.

j. Minimize the number of new kinds of equipment to be introduced while not sacrificing performance effectiveness.

k. Maximize standardization of systems, equipment, components and parts.

l. Have minimum logistic support problems.

m. Have adequate operationally oriented testing.

5. In view of the constraint of para 2i above requiring a firm production base line by October of 1974, insufficient time is available for development and testing of a completely new system design. Accordingly, this constraint requires limiting consideration to systems already reduced to hardware, which are the 505, 610E, half-frequency SOS-38, and DE 1160. Because the DE 1160 most nearly represents an on-the-shelf item at the upper end of the development spectrum (SECNAV INST 5000.1) in that it is about a decade more modern than the 505, 610E, or SOS-38, PMS-302 proposes to limit development effort to the DE 1160. This puts us in a sole-source situation with Raytheon, but we would be in a sole-source situation with either Westinghouse Canada or EDO if the 505, 610E or half-frequency SOS-38 were selected. Based on the above, the attributes cited in enclosure (1), and the concerns cited in reference (a) PMS-302 considers the following approach to providing a sonar system for the PF to be in the best interests of the PF program and the US Navy surface ship sonar effort.

a. Configure the lead PF to include the AN/SOS-38 sonar system as now installed on the Hamilton Class Coast Guard Cutters. Three such systems are now in inventory ready for immediate use with training facilities and full logistic support already in existence. The AN/SOS-38 is a service-approved system having undergone US Navy OT&E and is considered only as a fall-back position re the lead PF.

b. Provide sufficient cooling water facilities and electrical power for the DE 1160 in the lead PF.

c. Proceed with pre-production procurement and OT&E of the DE 1160, now undergoing prototype testing (with Navy participation), to meet the following schedule:

(1) By 2 October 1972, identify $5.5M FY-73 & 74 funds for procurement of three systems and Navy OT&E.

(2) Award a sole-source CPIF contract to Raytheon for three pre-production DE 1160's by 22 December 1972.

(3) Commence Navy OT&E by 1 September 1974 and complete OT&E by 1 April 1975.

d. Develop an optimum plan, expanding on enclosure (2), for either delivering a service-approved DE 1160 in lieu of the AN/SOS-38 to the lead PF in December 1975, or replacing the SOS-38 in the lead PF with the follow-ship system during PSA or first overhaul.

6. Procurement of a single foreign-made sonar of near obsolescence for the lead PF under the existing circumstances (AN/SOS-38's in US inventory and a system a decade more modern in prototype testing) is considered inadvisable. Such action will inject a one-of-a-kind sonar of mediocre capability and zero domestic logistic support (training, repair parts, technical services, etc.) into an inventory which NAVSHIPS is attempting to consolidate and update.

ATTRIBUTE/ASPECT	SQS-505	DE 1160
Approved for Service use (USN)	No	No
Relative Active Performance	1.0	1.1
Relative Passive Performance	1.0	1.2
Estimated Production Unit Cost (in FY 73 $)	$750K	$550K
Manufacturing lead time	15 mon.	12 mon.
Total deck area required (sq. ft.)	182	74
Total weight (lbs)	16,500	11,000
Total average power required (KW)	11.5	13
Cooling Water Required	No	Yes
Estimated Manning requirements	8	8
Number of cabinets	8	5
Standardization Features (OPNAVINST 4120.1 and NAVSHIPS Note 4120)	None except re Canadian 505 systems	Building Block approach: Uses BQR-XX Display, and BQS-XX and BQR-XX MOD Sub-assemblies
Availability of spaces (no. and type of cards)	Over 200 unique cards + piece parts	67 shp type (58 qualified)
State-of-the-art (time) reflected	1960	1970
Signal Processing	Analog	Digital
Built-in Perform. Monitoring/ Fault, location	Some	Yes
Rapid Installation Techniques	No	Yes
Valid sole source justification	Maybe	Yes
Buy American Act applicable	Yes	No

Enclosure (1)

THE DEPUTY SECRETARY OF DEFENSE
Washington, D.C. 20301

MEMORANDUM FOR THE SECRETARY OF NAVY

SUBJECT: Patrol Frigate Program

The DSARC review of the Patrol Frigate (PF) Program held 31 August 1972 found that the Navy had done a commendable job in the efforts to design the PF to a cost goal of $45M (FY 73 dollars) per ship. This is an excellent start, but the real job lies ahead in producing the ships within the cost goal. Based on past experience, this is going to be a very difficult task requiring both ingenuity and strong discipline.

I am pleased to note the strong effort to insure adequate test and evaluation (including IOT&E) prior to major contract for follow ships. However, the planned date for the first major contract for follow ships assumes that no critical deficiencies will be found during such testing. The Navy should continue to give emphasis to the completion of all feasible early T&E (including IOT&E) on the combat subsystems and on the land-based test sites. The DSARC and the DDT&E will evaluate at the time of their review of the Navy's recommendation to proceed with follow ships whether adequate test and evaluation (including IOT&E) has been accomplished with satisfactory results, and if not, whether some delay in contracting is warranted.

Also, it may be desirable that a period for operational test and evaluation of the lead ship, prior to that ship's full release to normal Fleet usage, be allocated to OPTEVFOR. The purpose of this testing would be to determine the PF's expected operational effectiveness in its expected roles and the need for any early modification to follow ships. Should such modifications be required, a later DSARC would have to determine the relative merits of opening existing contracts to change by change order procedures or making modifications after acceptance from the shipbuilder.

I have reached the following decisions:

a. The Navy is authorized to proceed with the program for development and construction of the PF lead ship and land-based test sites and advance procurement funding--$191.5M in FY 1973 for lead ship and land-based test sites and $17.0M in FY 1974 for advance procurement funding.

b. The Navy should continue its planning on the basis of the block construction schedule indicated in the DCP and in the FYDP (24 ships followed by 25 ships, the first block to be awarded to at least three different shipbuilders).

The number of PF follow-on ships and/or the need for any further study will be determined through the POM process.

c. 120 days in advance of a proposed DSARC III, an informal review of program test results and contract plans will be provided.

d. Approval of follow ship production should be contingent upon accomplishment of adequate test and evaluation (including IOT&E individually on subsystems, and collectively at land-based test sites) with satisfactory results. Data from such tests must be made available for examination prior to DSARC III, now scheduled for March 1975. In addition, logistics support for the all new systems and training and manpower allocations to support all new requirements shall be presented at the same time.

e. The Navy is requested to develop a plan for, and evaluate the impact of assigning the lead PF to OPTEVFOR for a reasonable period to complete an at-sea operational appraisal of the PF as a whole prior to the lead ship's full release for Fleet usage. This plan and evaluation, together with the Navy's recommendations, should be submitted to OSD at the time of preparation of the revision to the DCP for initiation of construction of the first follow ship.

f. In light of the strong start the Navy has made in the design of the PF to a cost of about $45M (FY 73 dollars unescalated), I want to insure that all efforts are made to insure that the cost goal is achieved in production. I therefore, direct that all periodic management and DSARC reviews highlight the Navy's performance in meeting a cost goal of $45M (in FY 73 dollars excluding shipbuilder escalation and outfitting and post delivery costs) and the reasons for any increases. A threshold of $50M under the same stipulation will be established in the DCP.

Deferred funds will be released by separate action.

Kenneth Rush

Enclosure (2)

APPENDIX C

COST ESTIMATING CASE

A. BRIEF

This case deals with budget cost estimating for the Patrol Frigate (PF) as an example of costing in a major acquisition project. The analysis made in this case should demonstrate some of the problems of early budget estimating, the use of cost estimating relationships and other techniques, and the accuracy involved in these tasks.

B. OBJECTIVES

The objectives for the student considering this case are:

1. To gain understanding of the problems and needs of budget estimations early in the program life.
2. To apply some of the techniques used in cost estimating and examine their use.

C. BACKGROUND

Budget cost estimating for shipbuilding is a task essential to the efficient and valid planning, programming, budgeting and management coordination of the appropriation program. It is an annual requirement for inputs to the Navy budget request and for updating the Five Year Defense Plan, for the Tentative Program Objectives Memorandum, and for the Program Objectives Memorandum. In addition, budget cost estimates are required periodically for various cost and

feasibility studies to determine the cost of various configurations for specific ships or classes of ships.

The building of ships and the conversion of ships under the SCN Program are totally dependent on the appropriation of sufficient funds to cover the "end cost" of the ships; because, after Congressional approval of the budget request, the Navy is obligated to the Congress to complete the ships authorized in a program year with the funds which were appropriated. The funds so appropriated are deemed sufficient to cover increased costs of labor and material, inaccurate estimates, administrative changes and technological advances (other than military characteristics changes of sufficient magnitude to warrant appropriation of additional funds by the Congress).

Insufficient funding could have serious impact on portions of the shipbuilding and conversion program, possibly necessitating cut-backs in ship capability or fleet effectiveness. For these reasons budget cost estimating must be handled accurately and timely.

Several techniques for budget cost estimating have been developed by cost analysts. One of the primary methods is the use of cost estimating relationships (CER). Essentially data on past, current, and projected programs is systematically collected and stored. The data is then analyzed with a view toward development of estimating relationships which may be used as a basis for determining the resource impact of future proposals. In the case of

military systems, these relationships would, ideally, relate various categories of resources to the system's physical characteristics, performance, and operation concept.

Without an extensive and continuously updated inventory of estimating relationships, resource analysis would be impossible. A few examples of these relationships are:

1. Initial tooling cost for turbo-jet airframes as a function of aircraft gross weight and speed.

2. Development cost for turbo-jet engines as a function of thrust, flight Mach number, and maximum compressor tip speed.

3. Ballistic missile booster cost as a function of missile weight, quantity, type of propellant and so on. (There would be separate relationships for each of the major components of the booster.)

4. High-power prime radar equipment cost as a function of peak power output and antenna area.

5. Aircraft depot maintenance cost as a function of aircraft gross weight, speed, and activity rate.

The resource that we are interested in ends up as dollars but may be estimated as labor hours, material, etc. For the PF acquisition, various cost estimating relationships based on the ship weight or characteristics have been used.

The principal model used to estimate the cost of the PF is the model maintained by NAVSHIPS 0161, the NAVSHIPS cost estimating branch. During the design of the ship, the weight of the ship is categorized in seven weight groups as shown on the attached form NAVSHIPS 4280/2. From the statistical analysis of past cost information by weight group such as is shown in Figure 1, the cost per ton for material and the number of labor hours per ton are estimated. For the PF the past data is adjusted with an inflation index for material

UNIT PRICE ANALYSIS - BASIC CONSTRUCTION

NAVSHIPS 4280/2 (REV. 1-67)

BIDDER	VESSEL
ADDRESS	

ITEM		DIRECT LABOR		DIRECT MATERIAL 1/	OVERHEAD
		HOURS	DOLLAR		
A.	ESTIMATED COST*				
1	HULL STRUCTURE		$	$	$
2	PROPULSION				
3	ELECTRIC PLANT				
4	COMMUNICATION AND CONTROL				
5	AUXILIARY SYSTEMS				
6	OUTFIT AND FURNISHINGS				
7	ARMAMENT				
8	DESIGN AND ENGINEERING SERVICES				
9	CONSTRUCTION SERVICES				
B.	SUB-TOTAL - COST		$	$	$
C.	PROPOSED PROFIT (% OF LINE B)				
D.	GRAND TOTAL - UNIT PRICE				

FIGURE I

SHIP SAMPLE COSTS (FY'73 $000)

SHIP SAMPLE	PF-107	DE-1037	WPG-715	DE-1040	DEG-4	DE-1052	DDG-2	DLG-16
HULL COST	907	1190	1679	2816	2703	3273	4393	6164
PROPULSION PLANT COST ***	1094	3421	7721	4520	4291	3615	9934	12258
ELECTRIC PLANT COST ***	398	1405	986	1753	1633	1798	2478	3749
COMM. & CONTROL COST	487	787	493	691	1053	1030	1160	1648
AUXIL. SYSTEMS COST	1130	2066	2767	2584	2928	3877	3234	4921
OUTFIT & FURN. COST	950	1833	2825	2484	2396	2951	2998	4431
ARMAMENT COST	120	270	236	531	647	551	414	1064
DESG. & ENG. SERV. COST	1194	544	2565	678	612	719	1542	1872
CONSTRUCTION SERV. COST	1398	1037	581	1304	1335	2025	2024	2384
TOTAL COST (FY'73 $000)**	7679	13353	19853	17361	17598	19840	28177	38491
PROJECTED WINNING BIDS*	6566*	13126*	19853	17749*	17598	18992*	28177	38491

*** INCLUDE THE COMPLETE COST OF PROPULSION MACHINERY AND GENERATOR SETS

** THESE COSTS DO NOT INCLUDE THE GOVERNMENT FURNISHED ELECTRONICS, NAVIGATION AND ORDNANCE EQUIPMENT AND OTHER ITEMS OF THE SCN APPROPRIATION WHICH MUST BE ADDED TO COMPLETE THE END COST OF THE SHIPS

* THESE COSTS ARE PROVIDED TO SHOW HOW THE WINNING BIDS WOULD COMPARE WITH THE PROJECTED COST OF THE FOUR SHIPS IN THE SHIP SAMPLE WHICH WERE NOT BASED ON WINNING BID

cost. Current labor costs per hour are multiplied by the labor hours required per ton. Groups eight and nine for engineering services are added as a percentage and profit is figured for the total price estimate. For the first ship non-recurring development costs must be added. A learning curve is used to estimate the cost of follow ships.

Figure 2 is a summary weight report which shows the "budgeted" and current estimates of weight by group.

D. REQUIREMENTS

1. Calculate the expected price of the ship if profit is ten percent, overhead 90 percent and services of groups eight and nine are six percent each.

One difficulty with this estimate is that past ships in the data base had steam propulsion rather than gas turbines in the propulsion system. The gas turbines are estimated at $1.5 million each and 46,009 pounds each. How should the estimate be adjusted?

2. The weight estimate shows total weight of the ship including government furnished equipment. What problems arise from this in estimation?

3. Figure 3 shows additional non-construction cost estimates. Prepare a total cost estimate. What are the non-recurring development costs? What range of accuracy do you think this estimate to be?

FIGURE 2

WEIGHT BY WEIGHT GROUP

WEIGHT GROUP TITLE	WEIGHT GROUP NUMBER	BUDGETED WEIGHT	CURRENT ESTIMATE	MATERIAL*DOLLARS PER TON	LABOR HOURS PER TON
HULL	1	1126	1108	428	212
PROPULSION	2	259	233	27,118	236
ELECTRICAL	3	168	135	11,162	592
COMMUNICATIONS	4	91	209	5,108	1,159
AUXILIARIES	5	335	278	7,172	813
OUTFITTING	6	248	224	3,534	611
ARMAMENT	7	82	89	4,922	382
		2309	2279		
LOAD		892			
		3400			

* FY 1973 DOLLARS

FIGURE 3

Cost Data for PF based on engineering evaluation as provided by the ship cost estimator. These are initial costs estimates and are expressed in FY 73 dollars.

COST ITEMS	COST BASIS	LEAD	FOLLOW
Design Changes	12% lead ship const. price	2.000	0.000
Construction Changes	26% lead ship const. price	2.500	1.400
Baseline Design & Services	Guestimate	5.000	1.000
Gov't. Engineering Support	DD-963 class estimates	3.000	1.500
Ship Test/Instrumentation	DE-1052 cost data	3.000	0.300
H/M/E Test/Instrumentation	DE-1052 cost data	3.000	0.000
Initial Stock Spares	H/M/E equip. list	4.000	0.000
Training Material Services	LHA cost data	1.500	0.100
NAVSEC Electronics	SEC 6271 estimate	3.188	3.188
NAVSHIPS Sonar	PMS 378 information	2.526	1.726
Propulsion Mach'y	Preliminary equip. list	7.186	5.215
H/M/E Equipment	Preliminary equip. list	1.400	1.400
NAVORD Cost	NAVORD estimate	34.265	8.852
NAVALEX Cost	SEC 6179 estimate	0.695	0.695
		73.260	25.376

APPENDIX D

SHIP SPECIFICATIONS CASE

A. BRIEF

This case investigates the concept of the ship acquisition specification. The first part of the case explains how technical requirements are made known to ship designers and shipbuilders through the medium of specifications. Problems in obtaining the proper mix of performance-type and design-type specifications to meet requirements of each step of the Patrol Frigate procurement cycle are considered. Although specifically addressing ship specifications, this same general problem exists for other systems. The second part of the case involves a review and an analysis of two separate specification package proposals. The student is required to determine the advantages and disadvantages of each specification package using the criteria included in the case for guidance.

B. OBJECTIVES

During investigation of this case the student will develop an understanding of:

1. The Concept of Ship Acquisition Specifications.
2. The difficulty of expressing ship system design results in a form appropriate for the start of ship design validation.
3. Performance-type specifications
4. Design-type specifications.

5. Problems encountered with lead ship- follow ship procurement.

6. Product baseline as applied to ships.

7. Various criteria used to judge and evaluate specification package proposals.

C. BACKGROUND

The Navy's technical requirements are made known to ship designers and shipbuilders through the medium of specifications. Thus, since the specifications are a primary means of communication between the Navy and its ship contractors it is crucial that they be suitable for the purpose intended. If it is the Navy's intent to assign ship performance responsibility to the shipbuilder, it is axiomatic that the designer/builder be given latitude in the design. In this case, performance type specifications are appropriate. However, if the Navy has or can achieve a design in which it has a high level of confidence, it can retain performance responsibility and assign industry the task of developing design details and of building the ship according to the Navy's basic design. In this case, design- (sometimes called construction) type specifications are appropriate.

Early in the PF procurement study, the significance of the type of specifications to be used was recognized. Much discussion among study personnel and with the Ships Acquisition Project Manager (SHAPM) ensued. Subsequent program developments impact on particular points in the discussion; however, they do not invalidate the concepts advanced.

The type of specification becomes a major consideration at four points during the PF Program, that is, during the procurement of:

1. Ship system design.
2. Ship design validation.
3. Lead ship and initial follow ships.
4. Remaining follow ships.

The types of specification which may be used for all phases must be considered in planning for ship system design so that the information needed for developing subsequent bid packages can be obtained from the designer.

There are basically two types of specifications. First there is the performance-type specification, such as that used in the DD963 program. The second is a design-type specification, such as that conventionally used with the contract design method of procurement. A performance-type specification may be defined as one in which only characteristics are specifically defined (such as capacity, function, and operation)--leaving to the design contractor (who is preferably also the shipbuilder) the details of design and structure. A design-type specification may be defined as one with which the required end product may be obtained from any qualified producer.

Most specifications used in ship procurements are a combination of these two types. In this context, performance-type specifications and design-type specifications may be considered as end points on a spectrum of specifications. A pure performance type specification has not to date been

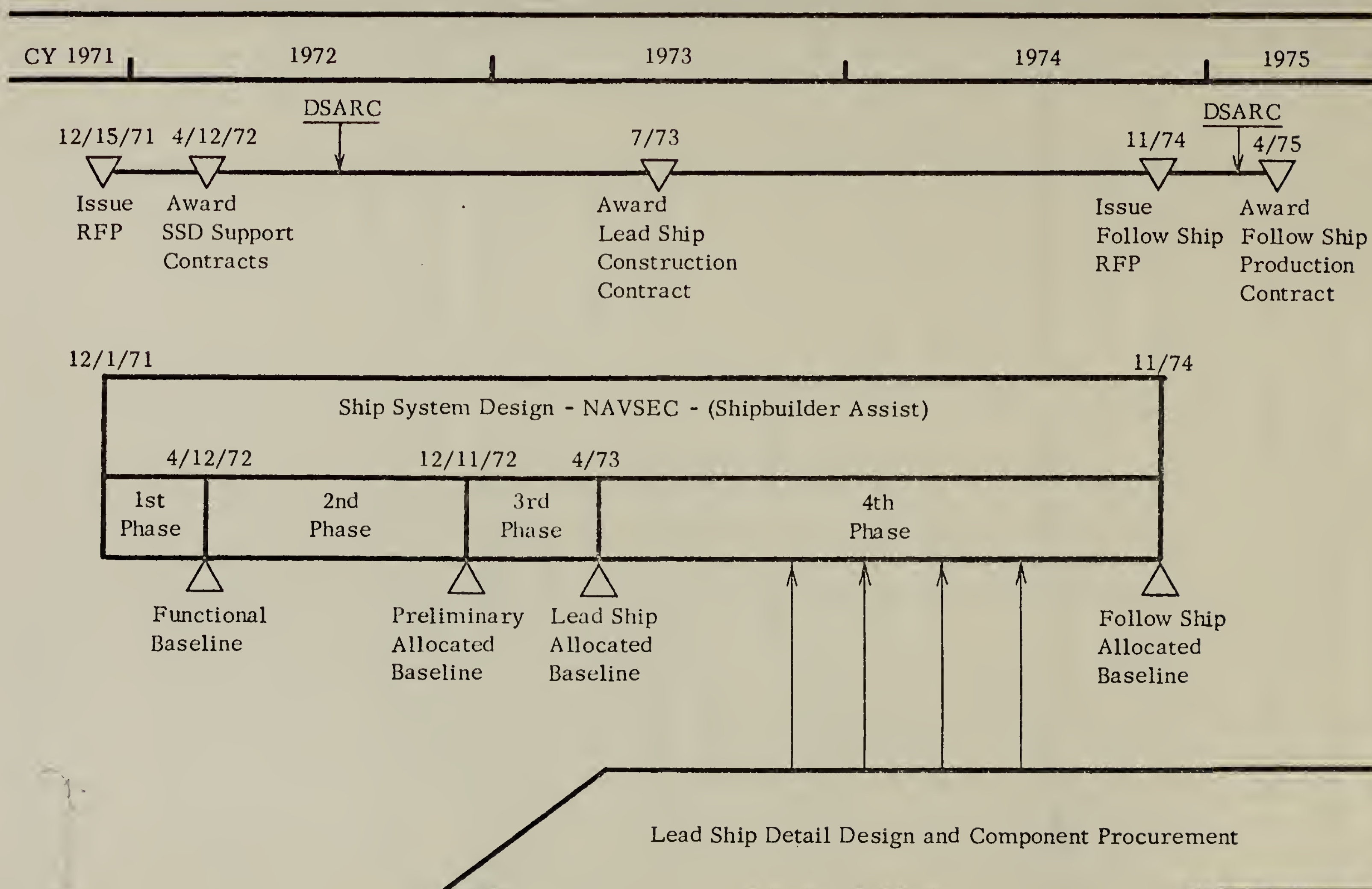
prepared for a ship procurement. Moreover, based on present plans for the Patrol Escort, the government will make the decision on many shipboard systems during the concept development portion of concept formulation and during the ship system design portion of concept validation; in some of these cases it will specify much of the system as government-furnished equipment (GFE). Consequently, it will be impossible to assign the shipbuilder "total system responsibility" for the ship system. With the Navy maintaining technical control during the ship system design, it is difficult to assign the builder responsibility for meeting the Functional Requirements Baseline (FRBL) even for non-specified subsystems.

At the other end of the specification spectrum are fully detailed design-type specifications, such as those prepared for the procurement of equipments and components. Except for some submarine procurements, such rigid requirements are rarely used when procuring ships.

The issue to be faced in early program planning is one of selecting from this spectrum of specification possibilities the correct mix of performance-type and design-type specifications to meet the requirements of each step of the PF procurement cycle.

Figure 1 depicts a schedule of related activities from the start of Ship System Design (SSD) through construction of the lead ship. As shown in the figure, the detail design specification starts with the release of the Follow Ship

FIGURE I
PATROL FRIGATE SCHEDULE



Allocated Baseline (FSABL) and evolves through to completion in five increments. The FSABL portion will be the basis for solicitation and award of follow ships. An extract from a PF FSABL document list is presented in Figure 2. The remaining five increments will be made part of the follow ship contract as they become available.

As may be noted from Figure 1, the FSABL portion is an output of Ship System Design. The remaining five increments are outputs of Detail Design as validated by (1) continuing land-based test sites activities, (2) actual construction of the lead ship and (3) Navy review and approval of selected portions of detail design data for follow ship contract application. Using a product baseline as the contractual basis for construction and acceptance of ships is a new approach for the Navy. A product baseline, as applied to ships, is a list of data by generic title, constituting a description of a single ship by hull number rather than a definition of the class. The product baseline is not considered a contract instrument for the procurement of follow ships. To help avoid confusion about terms, that body of data (FSABL plus five increments) is hereinafter called the ship acquisition specification.

FIGURE 2

PATROL FRIGATE FSABL DOCUMENT LIST

DOCUMENT NUMBER	TITLE	PF DELIVER-ABLE NUMBER	SECUTIRY CLASSIFI-CATION	DRAWINGS DRAWING NUMBER	DRAWINGS CATEGORY
S086	General Arrangement Inboard Profile	S1-4	C	4386534	C
S087	General Arrangement Outboard Profile	S1-4	C	4386535	C
S088	General Arrangement Maindeck and Above	S1-4	C	4386536	C
S099	General Arrangement 2nd Deck and Below	S1-4	C	4386537	C
C118	Equipment Removal Routes	C1-2a	C	4386538	C
	"Drawing Number Not Used"			4386539	
	"Drawing Number Not Used"			4386540	
C121	Arrangement Central Office Complex & Supply	C1-4	U	4386541	G
C089	Curves of Form, Bon Jean Curves & Cross Curves of Stability	C3-1	U	4386542	G
C075	Midship Section	C5-2	U	4386543	G
C096	Shell Plating & Typical Sections	C5-3a	U	4386544	G
C097	Decks and Platforms & Framing	C5-3b	U	4386545	G
C095	Deckhouse Structure	C5-3c	U	4386546	G
C107	Major Foundations (2 sheets)	C5-4	U	4386547	G
C122	Longitudinal Strength	C5-5	U	4386548	G
C105	Molded Lines & Body Plan	C6-1	U	4386549	G
C123	Rudder	C6-2	U	4386550	G
M162	Steering Room Layout	M1-1	U	4386551	G
M129	Auxiliary Propulsion Installation and Layout	M3-1	U	4386552	G

D. CONCEPT OF THE SHIP ACQUISITION SPECIFICATION

Considering the follow ship as a contract line item, the ship acquisition specification according to Harbridge House will be the only technical requirements statement or definition of that ship as it is to be built, outfitted, tested, and submitted for government acceptance, While it is an over-simplification, it is useful to envision a "perfect" PF lead ship as it would exist upon completion of Navy acceptance trials, and then think of the ship acquisition specification as a portion of that total body of data needed to describe that ship to a follow shipbuilder in terms that will enable him to produce an "identical" ship. More precisely, the ship acquisition specification is the top specification in a data tree invoking lower tier specifications and drawings. This data tree is organized to provide three levels of technical direction. The corresponding ship, compartment, and item level data are introduced below.

Ship level data considers the ship as a facility ready for installation and stowage of shipboard items, and also cites the tests, demonstrations, and trials attendant to government acceptance of the completed ship. Compartment level data is a sub-set of the ship's facility definition to treat each compartment as a unit. Items stowed or installed in the compartment are located (dimensioned) physically within the compartment, and by reference to a chain of lower level data; the precise definition of the item is ultimately specified. The compartment level data also includes

compartment unique requirements such as condition of readiness markings and paint schedules. Item level data is best described as a sub-set of the compartment level in terms of specifying (1) the item to be installed or stowed, (2) the interface requirements to be accommodated, and (3) the item peculiar installation and check out requirements. Item level data also controls the precise configuration of an item in terms of the item's purchase description, part number, "mark mod," installation information, pertinent technical publications and other item unique descriptors.

An objective of the PF procurement is to involve potential shipbuilders in the ship design at an early stage in order to improve the producibility of the design and the validity of cost and schedule estimates prior to release for production. In addition, the intent is to place as much responsibility for the performance of the ship on the builder as other program constraints permit. It is not an objective of the PF procurement to acquire competitive designs, as during Contract Definition for the DD963.

In order to meet these objectives, present plans are for a single shipbuilder to perform technical development of the ship, form the preliminary design stage to approximately the same level of detail as traditional contract design. At this point, in order to further validate the technical requirements, several potential shipbuilders will be given the design as a basis for preparing their proposals to build the lead ship and some of the follow ships. If the shipbuilder

is to assume a high level of performance responsibility, he must be given reasonable latitude in the product he proposes to deliver. In certain areas, it will be in the best interest of the government to clearly state detail requirements. For example, where the need for specific systems or equipments has been defined or specified by the government, the shipbuilder will not be allowed latitude. In remaining areas, if the objectives of the procurement are to be met, the shipbuilder must receive a statement of ship requirements in a form which allows him to build the ship to those detail requirements which best suit his facilities and production methods and for which he is willing to assume performance responsibility.

To implement this approach, the shipbuilders who will validate the ship design must be provided with that design in a form which depicts the ship requirements, but which does not constrain them unnecessarily in terms of the details of meeting these requirements.

Traditionally, the results of the second phase of ship design development (contract design) have been expressed in the form of contract specifications, contract drawings, and contract guidance drawings. For the procurement method proposed for the Patrol Escort, the ship specification which is to be made a part of the lead ship production contract will be the specification generated by the prospective builder during ship design validation and <u>may</u> look similar to the traditional contract design specification.

The problem, therefore, is to express the results of ship system design (heretofore called contract design) in a form appropriate for the start of ship design validation. This ship specification must clearly express the operational, functional, and technical requirements that must be achieved in the ships. These requirements must be stated in terms that do not unnecessarily constrain a prospective builder.

E. REQUIREMENTS

As the PF SHAPM you must determine the advantages and disadvantages of the following specification plan proposals.

1. (HH) The Harbridge House "build to" ship acquisition specification.

2. (RL) The Link "performance plus a plan" approach.

The following criteria should be used during your evaluation of the specification packages.

a. Promotion of the standardization of construction.

b. Savings from centralization of design.

c. Ease of administration of contract.

d. Avoidance of claims.

e. Standardization of equipment.

These later criteria may be more important since standardization of construction in ships may have little advantage to the Navy in comparison with standardization of equipment. Any savings in design could easily be offset by the repeated problems in construction.

The two proposals actually are not far apart. The Harbridge House specification does call for some performance specifications. The RL plan does provide the ship builder with a detailed plan which he may rely upon if he can demonstrate compliance. They both, then must address the central problem which is, "Can we prepare a timely detail design which will ensure performance." This is a very difficult question to answer. The major advantages and disadvantages of the plans relate to how heavily they rest on the Navy and the contractor being confident of the answer to this question. In other words, this is a risky area which will introduce confusion, hesitation and general uncertainty at the shipyards. Unfortunately such uncertainty works against the goals of the PF of minimal cost follow ships. Perhaps more important it may turn the currently positive attitude of the industry toward the PF program into a less positive one. Therefore before making a more detailed analysis the SHAPM should carefully explore the reaction of potential yards to any specification plan, and in general to choose a plan which causes least uncertainty at the yards.

For both plans a major portion of the problem will be the establishment of what constitutes conformance with the design. Although it would be possible to add the phrase all dimensions $\pm$ .xx feet, etc., it will be very difficult to decide exactly what xx should be, provide it to the shipbuilder before he signs the contract and defend the value selected in claims proceedings. If the builder receives test

statements, etc. after the contract is signed, he will be in an excellent position to institute claims because no one has enough experience to say what reasonable requirements are in this case.

Another problem is the requirement to pass the lead ship builders processes and procedures to other yards. This may be difficult and expensive to secure from the lead yard. Even if he wants to pass them, it will require a major effort to define and modify what they actually are since they are a part of his environment.

Using the previously mentioned criteria and considering the aforementioned problems determine which proposal is more advantageous to the Navy and reasons thereof.

F. THE HARBRIDGE HOUSE PROPOSAL

The results of the design effort performed by the ship system design contractor will be expressed in the form of drawings, specifications, and studies. The specifications will be similar in content to those used in traditional contract bid packages; however, they will contain more functional requirements than was the previous practice and will generally use detail requirements only where no latitude is to be allowed the shipbuilder. General Specifications and certain selected destroyer specifications will be useful to the ship system design contractor as reference material which expresses the present policy of the Navy in the construction of destroyer-type ships. The ship system design contractor will, using these references, extract the

functional requirements for shipboard systems and equipment and will develop, amplify, or revise existing specification write-ups to emphasize performance-type requirements and minimize detailed construction requirements. Design standards and details, such as the Design Data Sheets presently cited in specifications, will provide useful expressions of requirements.

As one of the first tasks in the ship system design effort, the contractor should prepare a preliminary specification for a "destroyer escort." This preliminary specification will be for the primary purpose of overall adequacy, rather than for final details, and should be submitted in draft form in time for a thorough review of each section by the responsible Navy codes and revision by the contractor prior to development of this "destroyer escort" specification in the Patrol Escort specification. Thus, by the end of ship system design, the contractor will be able to present specifications which have been approved in both form and content. Additionally, the contractor should develop a complete cross-reference from old to new format so that the existing specification requirements may be found in the new specifications during review. Documented justifications for the inclusion of any new requirements or for the omission of General Specifications requirements must be maintained.

Specification development will require a continuing dialogue between the ship system design contractor and the cognizant specification authority within the Navy in order to achieve a product at the end of ship system design which will express the results of the design development to the mutual satisfaction of the designer and the responsible NAVSEC codes. In some cases, such as combat systems, it may be advantageous to leave specification development with the NAVSEC codes. The level of total effort required by the ship system design contractor and NAVSEC to produce this type of specification may be double that normally required to produce a destroyer-type contract specification. The estimated efforts in the previous paragraph do not include the work which is presently in progress or under consideration in the Navy's specification improvement program.

Changes, such as a major reorganization of the specification format or major revisions in policies concerning what is shown on contract drawings, would involve additional effort by both NAVSEC and the ship system design contractor.

G. DESCRIPTION OF SHIP SYSTEM SPECIFICATION

The ship specification resulting from ship system design of the Patrol Escort can follow closely the present arrangement of the General Specifications. It is envisioned that most, if not all, of the present sections of the General Specifications (as applied to destroyers) will be included.

Each specification section should contain, as its first portion, a statement of the overall requirements and objective to be achieved for the Patrol Escort. Where appropriate, the general statement shall distinguish firm requirements and objectives. Stated differently, this first portion may contain the overall objectives, but within these objectives, it should state minimum satisfactory requirements for the Patrol Escort.

The second part of each section of the specifications should contain the detailed requirements which follow from the minimum general requirements. In those cases in which equipment selections or subsystem details are invoked by the government as firm requirements, they shall also be included. That descriptive and illustrative material which is presently used to explain the requirements and objectives should be omitted. Where considered necessary, it may be furnished in a separate document for the builder's information.

H. STATEMENT OF REQUIREMENTS

The requirements and objectives expressed in the specifications should be of the performance-type insofar as possible. It is recognized that statements of what a system should do (that is, performance) are not always adequate to fully express the Navy's functional requirements. In a combatant ship specification, system characteristics are often as important as system performance, however, weight requirements are also a critical element in the selection of appropriate shipboard systems. As another example, shock requirements are not

directly related to system performance, but they are critical to continued performance under adverse conditions. General requirements, such as shock criteria and operation under conditions of roll or heel, will ordinarily be expressed in the general requirements section of the specification. Statements for each subsystem will be necessary only when the minimum acceptable requirement varies from the general statement. In summary, the specifications must continue to describe the ship, but particular care should be used in this new variety to define what it is the shipbuilder must deliver, rather than how he is to procure or produce it.

I. SUMMARY OF HARBRIDGE HOUSE RECOMMENDATIONS

1. Ship System Design

The ship specifications used in procuring ship system design should be of the performance-type except for such specific ship systems as propulsion, communications command and control, and so forth, which will be identified by the government so as to avoid superfluous study in areas in which decisions have already been made. This identification of specific subsystems may be compared to a type of positive guidance.

2. Ship Design Validation

The ship specifications provided to the shipbuilder for validation will be the output of ship system design. It is recommended that, except in the areas in which firm system-equipment decions have been made, performance-type specifications be used.

This will involve new procedures. Contract design specifications which are based on marked-up General Specifications contain too many detailed requirements to be suitable for the start of ship design validation. However, General Specifications do represent the compilation of existing Navy shipbuilding policy and practices, and it will be necessary to charge the ship system designer (or some other agency) with the task of extracting subsystem performance requirements from these specifications.

3. <u>Lead Ships and Initial Follow Ship</u>

The ship specifications used in procuring lead ships and initial follow ships should have a government-controlled baseline that is no more detailed than is necessary to express the requirements. This will allow the shipbuilder reasonable flexibility as to how the performance is achieved.

4. <u>Follow Ships from Other than the Lead Shipyard</u>

The policy used when developing ship specifications for procuring follow ships from other than the lead shipyard should be the reverse of that used for lead ships and initial follow ships; that is, the government-controlled baseline should be as detailed as is necessary to achieve the standardization which is required for ship operation and logistic support.

J. THE LINK PROPOSAL

In the PF program there is not time for the ship acquisition specification to be generated after the completion of tests on the lead ship. Timing forces the need for a plan to be developed in context with three basic needs. First, the initial release (the FSABL portion) must be adequate to negotiate follow ship contracts with a "not-to-exceed" ceiling price. Secondly, the follow yards need to know the nature, content, and schedule for the remaining five increments of data in order to plan and execute their production efforts. Lastly, all elements of the ship acquisition specification must be both accurate and timely.

As an aid in the understanding of this plan, it is useful to distinguish between some development and production activities. The Lead Ship Allocated Baseline (LSABL) is a performance requirement oriented technical data package intended to serve as the Navy's technical statement of work to the designated lead shipbuilder. Consider that the Navy could award a Detail Design contract against the LSABL to the lead yard calling for delivery of a production oriented technical data package--the ship acquisition specification (as a CDRL item)--without awarding a lead ship. Extending the hypothesis, NAVSEC could then review the delivered data and declare that ship acquisition specification data as being adequate for production contracts for follow ships. The lead yard would be the developer, having reduced performance to a practical design solution by virtue of his experience alone.

The foregoing distortion was deliberate to help focus on the following points:

1. The ship acquisition specification could be generated independently of the award and construction of the lead ship or the Land Based Test Sites (LBTS), or both.

2. The ship acquisition specification could be generated on a schedule such that every item of technical data was reviewed and approved by the Navy prior to using that data for lead ship construction of the LBTS.

3. The Lead Ship and LBTS contracts could specify that Navy approved ship acquisition specification data (and no other) must be used as the basis for procurement, fabrication, assembly, test, check-out, installation, T&E and any other action requiring technical direction (including unique processes) to deliver the lead ship and sites under the contract(s).

4. The Navy could monitor the aggregate of construction activities in three above to help ensure:

a. that the requirement statement was complete for the purpose intended (i.e. procurement, fabrication, etc.).

b. that the test statement was adequate for accepting or rejecting material produced in accordance with the requirement statement.

c. that changes in (a) and (b) or both are reflected in the data. In this case, actions in (a) and (b) or both are repeated after the change is made to data and hardware.

d. that the ship acquisition specification data are complete and delivered on schedule with unlimited rights to use the data for competitive production (procurement) of identical or like items.

e. that adequate Test Memoranda (or equivalent), T&E plans and QA plans can be developed independent of the Navy and operate satisfactorily in practice.

5. The Navy could self-impose the equivalent of the foregoing on participating commands and activities.

The points established above are the foundation upon which this plan is based. Clearly, design and construction of the lead ship must be viewed as a means to an end. The critical product of this effort is a validated technical data package suitable to contract for production of follow ships by follow yards.

With respect to the immediate task of generating FSABL, as the initial portion of the ship acquisition specification, it should be re-emphasized that the LSABL and the FSABL perform two different functions in the PF program. The LSABL governs development separately, the FSABL is part of that data intended to govern subsequent production, under new and different contract terms. It is, therefore, risky to expect the normal conventional evolution (expansion and refinement) of the LSABL in the FSABL to make the conversion from development requirements to production requirements. Those concerned with the generation of these data will be asked to consider these related but clearly separate efforts carefully in light of the markedly different intended use of the data. Further, T&E, QA, and supporting commands and activities, will be asked to participate in the design process actively, differently, and much earlier than in prior efforts.

K. GENERAL REQUIREMENTS

In context with the PF Program, the concept of the ship acquisition specification will be reduced to practice in accordance with several principals set forth below.

1. The ship acquisition specification will be limited to a technical description of the ship. Administrative information, deliverable data requirements, and the like information contained in the "Gen Specs" will be omitted. Process data judged critical to the achievement of a technical requirement is considered to be technical data and will be included.

2. The ship acquisition specification data will consist of two primary components of information. These components are independent of either the level of data indenture or the relative technical importance of the data. These components are (1) requirement statements and (2) test statements. To elaborate, a requirement statement should be taken literally, that is, to mean any technical requirement from a weld length--to a power supply surge--to the ship's turning radius. No distinction should be made between "performance," "design," "process," "structural" or any other requirement for purposes of understanding the component of the ship acquisition specification data that sets forth the technical requirements for the ship. Requirement statements will be quantitative with "GO-NO GO" accept or reject limits.

With regard to test statements, several distinctions apply.

a. A test statement is intended to prescribe the means of determining compliance or non-compliance to a requirement

statement. These "means" range from visual inspection of painted surfaces to measuring shaft run-out, to ship level-fuel consumption determinations.

b. A test statement must contain enough information to enable the shipbuilder to determine at least one way to satisfy the test statement. However, because the Navy also determines acceptability, it is helpful to distinguish between Quality Assurance (QA) and Test and Evaluation (T&E) for further clarification. Generally, T&E oriented test statements will require the shipbuilder to interpret the test statement and prepare a Test Memoranda (or equivalent). Further, because more than one procedure can usually be devised to meet the test statement, Navy concurrence in the responsiveness and adequacy of the contractor proposed procedure will be required. Typically, the equivalent of a Test Memoranda will be specified as a deliverable data item subject to government acceptance and thereafter substitutes (operates contractually) for the test statement specified in the ship acquisition specification. Rarely should it be necessary for the ship acquisition specification to specify the sequence in which test statements are to be conducted. Except when damage to equipment or to personnel relate to sequence of testing, such matters will be excluded from the ship acquisition specification left to the shipbuilder's T&E plan.

Quality Assurance (less T&E as discussed above) relates to test statements in a different way. To illustrate one extreme, consider a foundation drawing showing a plate thickness of two inches, plus or minus one-sixteenth inch. Here the test statement is the allowable tolerance range already specified as part of the requirement statement. No further test statement is needed but more importantly, the range of options open to the contractor to demonstrate compliance to such requirements will have already been reduced to a "standard practice," followed within that yard in all such cases. These "standard practices" are generally industry accepted techniques which vary little from yard to yard and are of such minor concern to the Navy that a compliance demonstration would reduce to having contracted with a qualified shipbuilder.

In context with the ship acquisition specification, test statements may fall in a range from specified "T&E" to "industry practice," which represents the two ends of the test spectrum. Test statements falling in the middle of the range will be specified sufficiently to first ensure the government's inspector (activity) has enough information to independently accept or reject without recourse to other data, and secondly, to support the contractor's preparation of his quality assurance plan, including inspection procedures. (Such judgments are best made by SupShip's personnel and their shipyard counterparts.)

To summarize:

a. T&E test statements will be specified in the ship acquisition specification and may be expected to lead to test memoranda that are subsequently approved by the Navy. T&E test statements are also scheduled by a T&E plan that the Navy approves. Test sequences will not generally be specified in the ship acquisition specification.

b. Industry practice will not be subject to separate test statements, nor will statements such as "workmanship must be first class" be included. Assume a pre-award survey and subsequent surveillance will be substitute for test statements.

c. Test statemetns for requirement statements not covered in (a) or (b) above will be required. These test statements are QA requirement inputs. Assume that Navy approval of the shipbuilder's QA Plan and subsequent on site Navy activity will cover the general case. Given this assumption, test memoranda will not be generated.

d. Test Memoranda, T&E Plans and QA Plans derive from the ship acquisition specification but are not part of the ship acquisition specification. However, close internal coordination is mandatory to obtain concurrence that requirement statements and test statements are adequate prior to inclusion in the ship acquisition specification.

3. If a performance oriented requirement statement is completely controlled by design requirement statements, the performance oriented requirement statement will generally be deleted. Judgments in this area must consider the relative risk (uncertainty) of determining compliance to the design requirement. When a performance requirement of critical consequence is under consideration always "back-up" the design requirement with a performance test statement, but at the same time, recognize that a modified (simpler and easier) test can often provide an acceptable confidence level.

4. To obtain ships that are suitable on the operational inventory, a certain number of tests and selected demonstrations will be considered vital by the user as a condition of his acceptance. Theoretically, these capabilities are inherent in the design; and ships built in accordance with the design are acceptable without further tests. In practice, however, few engineers claim to be able to determine that hardware always equals the data without some reservations. These situations support the following ground rules:

a. User-oriented tests will be included in the ship acquisition specification to the extent necessary to ensure delivery of acceptable ships. These tests are included so that the Navy may, in the face of a deficiency, decide upon corrective action without taking delivery of the ship without regard to the extent to which the shipbuilder met the detail design.

b. Other performance tests of critical interest to the designer may be specified in the ship acquisition specification for reasons stated above.

c. Deficiencies will generally be resolved by correcting the fault in either the Navy's design or the builder's noncompliance to the design. In other cases, the design and hardware will be satisfactory with the fault attributable to the Navy's test statement or the builder's method of demonstration. In exceptional cases, the basic performance requirement (a or b) will be revised. Other outcomes, including acceptance of the ship with the deficiency are, of course, possible; along with combination of those noted above. The principle being highlighted here is that the ship acquisition specification, as a detail design specification will contain performance requirements--not to prove the design, not to prove the adequacy of the QA/T&E program, not as a basis for determining financial responsibility--but primarily to place delivery of an acceptable ship clearly within the scope of the follow ship contract(s).

5. Requirement statements will not be repeated.

APPENDIX E

CENTRALIZED PROCUREMENT CASE

A. BRIEF

In shipbuilding a substantial fraction of the total cost is due to equipment installed on the ship by the builder. This equipment falls into two general classifications: that equipment which is furnished by the government for installation by the builder is called Government Furnished Equipment (GFE) or Government Furnished Material (GFM); that equipment which is not furnished by the government is procured by the builder for installation and is referred to as non-GFE or non-GFM. This case deals with the problems regarding procurement of this latter type of equipment, non-GFE, for the Patrol Frigate (PF) acquisition. These problems are complicated by the production of the follow-ships of the class in a number of shipyards and the desire to procure the equipment using a central agency.

OBJECTIVES

The objectives for the student considering this case are:

1. To gain an understanding of the advantages and disadvantages of centralized procurement of weapon system equipment.

2. To examine approaches which may be made to the centralized procurement concept.

3. To apply analysis techniques used in procurement planning and contract administration.

C. BACKGROUND

The procurement plan for the PF is based on a lead shipbuilder and several follow shipbuilders. GFM will be centrally procured, that is contracted, purchased and distributed by one agency. The procurement plan for other equipment is the issue addressed here. Allowing each follow shipbuilder to procure equipment independently endangers standardization. A centralized procurement plan wherein the PM office, NAVSEC, the Lead Yard, some special group formed for the purpose, or a combination of the above procures all non-GFE items, might save equipment acquisition and life cycle cost but could increase the government's liability to claims by follow shipbuilders as well as increase the risk of delay. This increase in claims liability would be due to the government's assumption of the responsibility for the timely availability of the proper equipment.

The factors which should be considered in determining the desirability of central procurement for each item are:

1. Standardization for military necessity.

   Standardization of equipments designated for quick turn around is mandatory. Non-standardization in this case would violate modern maintenance concepts. Quick replacement and/or repair as well as a well-organized preventive maintenance system depend upon a large degree of standardization within a ship class. Without this standardization ships time on the line could be drastically reduced by lack of parts or maintenance requirements beyond planned capability.

2. Standardization to maintain benefits derived during the design phase.

The benefits are technical compatability, RMA certification, training facilities in being, and supply support. Without standardization these benefits extend only as far as the lead ship for all follow ships will be different.

3. Material and administration costs.

Central procurement should reduce the cost to the government of the material purchased simply because of the lot size involved and the fact that many of the items require tooling or set-up costs which would only have to be met once with central procurement. On the other hand, administration costs would be expected to rise since the central procurement agency would have to be funded. Testing alone could amount to a half million dollars.

4. Amount of investment required.

Centralized procurement of an item would essentially require the obligation of funds to purchase the item for all 50 ships of the class unless options are used. Some of this money would have to be advanced to vendors.

5. Risk of supplier failure and program delay.

If an item is to be centrally procured and only one vendor is to be used, the failure of this vendor to supply on time could delay the production of the entire class while a new vendor is found, contracts negotiated, and production begun on the item again.

6. Government claim liability.

If the government directs centralized procurement of an item and delivery is delayed because of failure of the item to be delivered on time and/or in accordance with specifications, then the government is liable to claims by the builders as if the item were GFM.

7. Possible new rules on multi-year contracts.

The production of the PF class will extend for several years and centralized procurement of an item will require obligation of the government on a multi-year basis. This could be dis-allowed or regulated by Congress in the future because of difficulties with Litton on cancellation costs of LHA.

8. PF procurement plan.

The plan calls for two blocks of ship production over five fiscal years with three yards being used and deliveries made at the rate of one per month.

In general, the advantages of centralized procurement are higher standardization and lower material and procurement administration costs. The disadvantages are higher risks of delay and of claims. These questions shall be discussed in further detail.

The claims problem can be understood by consideration of Figure 1. The results of the two main causes of claims, errors in government specifications and delay of delivery by the supplier are shown for both centralized and non-centralized procurement.

PROCUREMENT TYPE	ERROR IN GOVT. SPECS	LATE DELIVERY BY SUPPLIER
CENTRALIZED	CLAIM	CLAIM
NON-CENTRALIZED (FOLLOW YARD)	CLAIM	NO CLAIM

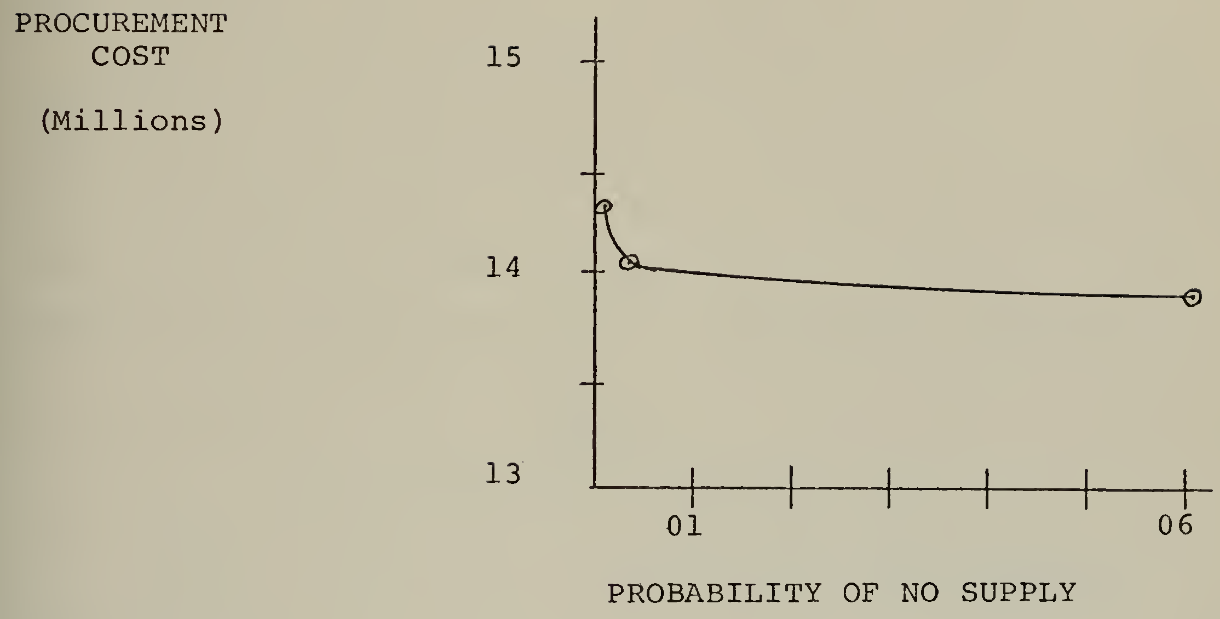
Figure 1

The degree of standardization depends both on the degree of centralization and on the policy of the centralized procurement agency with regard to the number of suppliers. If six or eight follow yards can buy from a large number of suppliers, there will be almost no standardization. On the other hand, if three yards individually purchase from a very

limited number of suppliers, the standardization may be very high although less than perfect. Centralized procurement agencies themselves often develop several suppliers in order to reduce prices and curtail risk, which in turn reduces standardization. Therefore, complete standardization is, in fact, rarely achieved. The standardization question requires a detailed look at the number of suppliers for each major item.

The risk versus cost trade-off is fairly obvious. Item cost is reduced if the fixed cost is allocated over additional quantities. But the decrease per item drops rapidly as the number of items increases. As an example, we choose the Controlable Reversible Pitch Propellor (CRP) for which a cost of $540,000 has been estimated. Suppose 50% of this amount is the fixed cost. The cost savings for one supplier of 50 would be $270,000 versus two suppliers or $540,000 versus three suppliers. This is only four percent of the estimated $13,500,000 cost of the 50 CRP's. The trade-off is the increased risk of cut-off or delay of the items supplied. Suppose the risk of any one supplier not meeting his commitment is five percent and the probability of failure is independent between suppliers. Then the trade-off curve of Figure 2 can be plotted:

FIGURE 2



A second example of how the cost trade-off must be made is shown in Figure 3. This is a table of bids received on the reduction gear for the propulsion system. A short history of each of the companies past performance is given in the DATA section of the case. The decision which must be made is again how many suppliers should be used.

FIGURE 3

PRICES	COMPANIES		
	A	B	C
FIRST UNIT	3.6	2.4	3.8
UNITS 2-50	.6	.9	.8

The non-GFE equipment to be procured for the PF falls into two categories: the propulsion system, approximately $6 million per ship; and other non-GFE which totals only $1 million per ship. While much of the propulsion equipment is long-lead-time material, most of the latter non-propulsion equipment is not. The difference in these groups of non-GFE equipment, particularly with regard to lead-time, allows the possibility of different treatment of the two groups. The non-GFE, non-propulsion equipment is listed in Figure 4.

FIGURE 4

Non-GFE Non-PROPULSTION EQUIPMENT

ITEM	COSTS ($1000)
Switchboards	76
Motor Generators	160
Distilling Plant	44
Air Compressors	196
Liquid Oxygen System	22
Windlass & Capstan	45
Boat, Davit, & Winch	38
Hoists	13
Reefer System	20
Separators & Filters	44
Pumps	181
Eductors	8
Heaters	25
Vent. Fans & Controls	66
Air Conditioning & Cooling Cont.	34
Heating Equipment	22
	$983

Not including auxiliary propulsion boilers, $150,000, diesel generators, $480,000; furniture, galley equipment, incinerator and sewage facilities or air conditioners, $66,000 because standardization may be automatic for these items. However, these could add as much as another million dollars.

Several decisions regarding centralized procurement of the propulsion system have already been made:

1. The decision for centralized procurement.
2. The decision not to go GFE.

Moreover, it is likely that the propulsion centralized procurement agency must be Bath Iron Works (BIW) because they are already in the process of selecting vendors for the Land Based Test Site (LBTS) and lead ship. Long-lead-time requirements dictate that propulsion system orders be placed prior to award of follow ship contracts. It would be necessary to duplicate BIW's initial effort if some other company served as centralized procurement agent for the propulsion system. In addition the valuable experience gained by BIW in the design and initial procurement would be lost.

The past decisions and time considerations essentially dictate that BIW will be the centralized procurement agent for the propulsion system. The BIW contract requires them to submit a procurement plan for the propulsion system. This procurement plan is attached to the case in the DATA section.

The remaining alternatives in the propulsion system procurement deal with how BIW should proceed with the central procurement. One decision is whether they should actually buy the equipment for the first follow ships and take title to the equipment or merely negotiate procurement contracts with options for each of the follow shipbuilders. The final decision is exactly how the option should be written and implemented. The BIW plan includes recommendations for this.

The major question is whether the option should be placed in the contract for the lead ship and LBTS or whether a competition should be held after the LBTS results are known.

For the non-propulsion equipment there are many more alternatives because time is not as important and no previous decisions have been made. The major alternatives are:

1. Follow shipbuilders procure individually.

2. Joint venture of all builders in selecting vendors. Each builder then required to buy from selected vendors.

3. Lead shipbuilder selects vendors and negotiates contracts with option for follow shipbuilders if they desire. Standardization will not be a factor in proposal evaluation.

4. Same as 3. except selected vendors and prices are specified in the RFP and follow shipbuilders are allowed to specify other vendors if desired. Proposals would be evaluated for amount of standardization.

5. Same as 3. except follow shipbuilders required to buy from the selected vendors.

6. Government furnished equipment.

The first and last alternatives are probably not serious alternatives. Individual procurement for all items would mean passing up the only chance at standardization for 1/4 to 1/3 of the escort fleet for the next 25 years. There certainly are many items which can be centrally procured with virtually no claim liability for the government. At least these should be centrally procured.

The GFE option also has some serious drawbacks. First is the increased government liability for claims. This apparently led to the earlier rejection of GFE for the propulsion system by higher authorities. Second is the problem

of finding an adequate procurement organization within the Navy that will be responsive to the SHAPM. Although we might explore this alternative further, it does not look promising.

This list of six alternatives is, therefore, narrowed to four, which can be further narrowed into two major decisons:

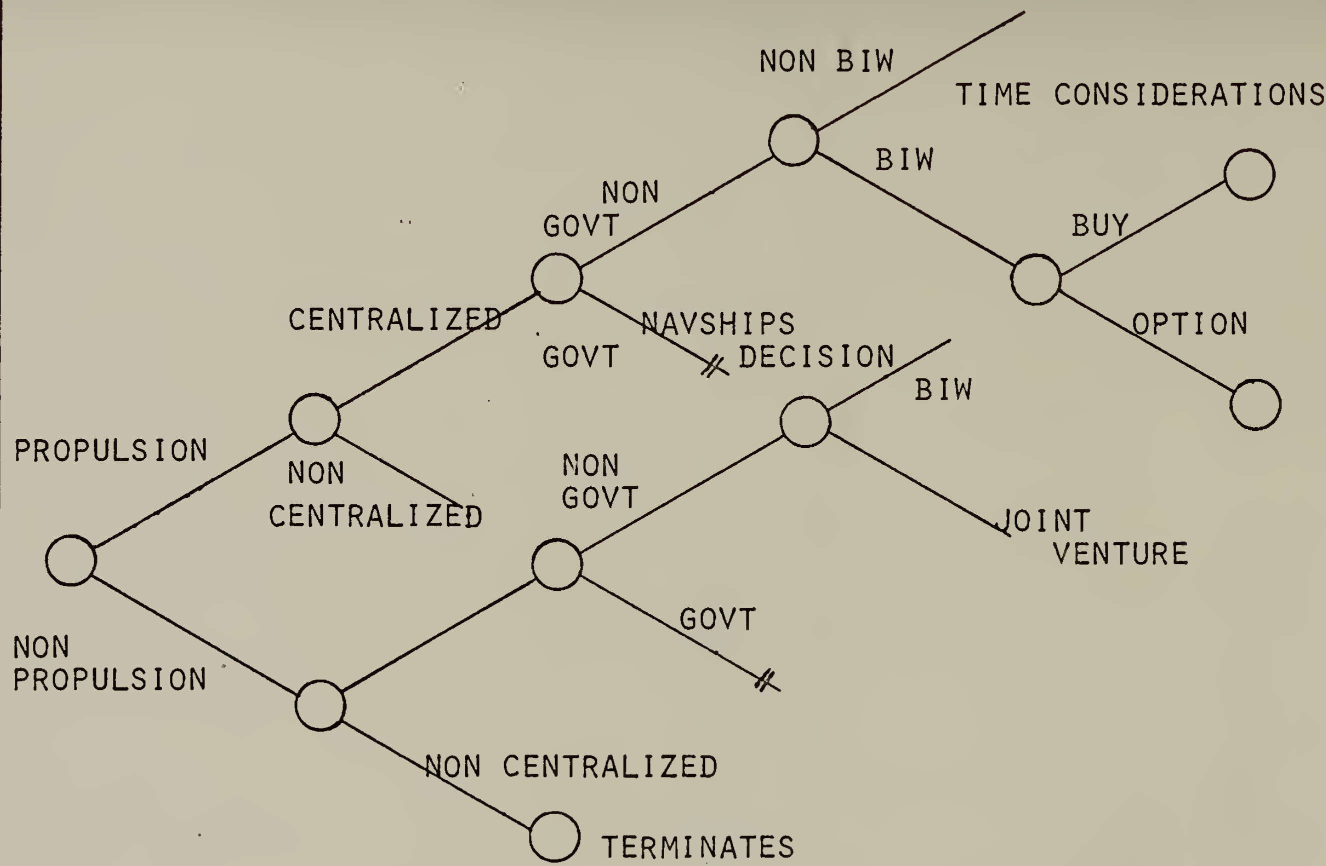
1. The make-up of the central procurement agent, whether it should be the lead shipbuilder, or whether it should be a joint venture.

   The advantage of joint venture is that all builders participate in the equipment selection, further reducing the potential for claims against the government on the basis of late delivery. The disadvantage is the organizational difficulty and, therefore, resistance of the builders to the method. An attempt might be made to determine whether a satisfactory organization can be determined, with the aid of Bath.

2. The degree to which the option should be compulsory or whether shipbuilders should be allowed to substitute other vendors. The alternatives here range from no compulsion, alternative 3, to complete compulsion, alternative 5. Alternative 4 is a compromise which makes the shipbuilder justify non-standardization and allows the SHAPM to penalize bidders who have a high degree of non-standardization.

   Making the option compulsory is undesirable in that it limits the ability of the builder to respond to local conditions and increases the potential government claim liability. The "government specified equipment" has the same late delivery claim problem as GFE. It should be used only if reasonable standardization cannot be ensured by other techniques; including a standardization evaluation and/or standardization penalty. This problem requires further evaluation. The SSN-688 program attempted a non-compulsory option which failed, apparently because a central procurement agent felt the Navy had limited its choices.

   A decision tree for the centralized procurement problem is presented as Figure 5.



CFE CENTRALIZED PROCUREMENT DECISION TREE

FIGURE 5

D. REQUIREMENTS

1. Recommend either the option or outright purchase method or combination for the propulsion equipment. If the option is chosen, propose wording for the option and determine whether or not it should be placed in the contract for the lead ship and LBTS.

2. Recommend a plan for centralized procurement of non-propulsion equipment.

3. Develop a plan for centralized procurement activities necessary after the expiration of the Ship System Design (SSD) contract.

E. DATA

Enclosure (1): Performance history for Companies A, B, and C

Enclosure (2): Bath Iron Works proposed Central Procurement Plan

ENCLOSURE 1

Briefly outlined below are comments and findings which should contribute to an overall preference rating of Companies A, B, and C.

I. Company A, Lockhaven, California

A. Recent reorganization of Company A has resulted in the appointment of Mr. P.J. Dolittle as President and Mr. I.M. Curious as Vice President/Division Manager of the Lockhaven facility. Both individuals exhibited a rare degree of administrative capability and demonstrated an awareness of in-house programs and first hand knowledge of personnel. Each of the management personnel has exhibited a knowledge of and responsiveness to PF Program requirements. It was noted that the Lockhaven facility dedicates approximately 50 percent of its capacity to commercial work and the other 50 percent to military oriented efforts in such areas as marine gears, actuator systems for aircraft and cargo handling systems for air/ground support. They are currently producing at about 50 percent capacity.

B. The following are brief comments on various aspects of Company A:

1. Facilities and Equipment appear adequate at this time to handle initial PF Program requirements, with no immediate need to increase facilities, equipment, or personnel. Follow-ship program--it was felt might require additional personnel and/or equipment.

2. It was noted that this company has never had a strike and that it is in a substantial unemployment area.

3. All internal functions such as purchasing, financial and manufacturing are autonomous by division.

4. Company A owns 80 - 90 percent of all tooling and facilities that would be utilized for the PF requirements, while the balance are Government-Owned Facilities, under Contract FAC #AF (657)-69-C-0490.

5. An in depth review of Manufacturing/Production Control/Quality Assurance Programs revealed systems that are compatible with BIW needs.

6. Configuration Management System, current Engineering Change Control Procedures and Quality Assurance Programs were reviewed. Individual discussions with the various managers involved coupled with the reviews demonstrated a superior approach to hardware and software requirements.

7. Purchasing, Estimating and Cost Accounting Systems were reviewed and found adequate.

8. Current organization and proposed program management plans including the designation of specific individuals with responsibilities in these areas, evidenced management and corporation awareness and support.

9. The review of the proposed milestone program and in-house capabilities gave assurance that Company A, if selected to supply reduction gears is capable of meeting its obligation to furnish quality equipment on schedule for LBTS, lead ship and follow-ship sets.

10. A separate in-depth financial review by BIW Management has been accomplished. No major drawbacks were found after review of Company A.

II. Company B, Pilgrim, Massachusetts

A. This facility operating under the guidance of Mr. D.S. Bennet, General Manager, who did not participate in discussions, exhibited an on-going capability for the production of marine reduction gearing for both commercial and military application. It was noted that Company B has been furnishing ships' propulsion gearing to the U.S. Navy for a lengthy period, is currently involved in programs such as the SSN-688 and has furnished gearing for the DLG, DE, LSD, and AOR. In total, they have furnished ships' propulsion equipment (Steam Turbines and gears) for over 500 vessels in military, Merchant Marine and commercial service. Normally, work distribution is approximately one-third (1/3) Government oriented, one-third (1/3) commercial and the remaining portion is dedicated to export (foreign needs). The workload specified above represents approximately 85 percent of this department's volume, while 15 percent encompasses industrial, utility and test gearing for locomotives, traction vehicles, high performance compressor gearing and hydrofoil type transmissions.

B. The following are brief notations on various aspects of Company B:

1. This company currently employs 1100 people and review and discussions of facilities, personnel and

equipment indicate that it could absorb LBTS, lead ship and follow-ship requirements with no impact upon present capabilities.

The use of Government owned facilities will not be required in the performance of requirements for the PF Program.

2. Review of strike history showed a major strike (16 weeks duration) in 1969, and two smaller strikes in years previous. Discussion with Management disclosed that they do not anticipate further labor difficulties.

3. This company is in a substantial Labor Surplus Area.

4. Company B maintains separate profit centers by department and/or divisions and although separate balance/operating statements are maintained they are company proprietary.

5. Organization and projected program management approach appeared to be compatible with PF needs. All management personnel were keyed to and appeared capable of handling a multi-ship program of large magnitude.

6. Observation and discussion of Engineering/Manufacturing, Product Control and Quality Assurance Programs indicated adequacy and good traceability which should result in reliable end products.

7. Their Cost Accounting System, it is felt, requires additional review.

8. A brief review of the purchasing function showed that some improvement in internal paperwork flow and turn around times would be beneficial to the PF Program.

9. A degree of internal interface redundancy exists.

10. During the course of our discussions, BIW received no evidence of divisional management support. A program such as the PF demands vigorous, attentive support in order that program objectives be attained.

C. In summary, it must be stated that any lack of management participation and direction coupled with high production-rate observed may result in lack of control on the part of Navy, prime and subcontractors.

III. Company C, Sunnyside, California

A. The recent merger of the Missile Launching and Handling Division with the Marine Division has created a large (2200 employees) organization that demonstrates the capability of handling a complex multi-ship procurement such as the PF Program.

B. The following are brief notations on various aspects of Company C:

1. The Marine Division, under the guidance of J.T. Door, General Manager and T.E. Edwards, Deputy General Manager, was selected for and is proceeding with the manufacture and testing of reduction gearing and associated equipment for the DD963 Program.

2. All management personnel with whom discussions were held demonstrated an awareness of PF Program requirements and assimilated these requirements with the on-going DD963 Program.

3. Approximately 85 percent of current workload is Government oriented. Plant, facilities, personnel and equipment appeared adequate to handle PF Program requirements for LBTS and lead ship.

4. Performance capability on follow ship requirements is questionable.

5. Company C is in a substantial Labor Surplus Area.

6. Review of strike history reveals that there has been one strike (three weeks duration) which affected the Marine Division since 1950.

7. As a public corporation all internal functions are independent by division within the corporation.

8. Current balance and operating sheets for the Marine Division were not available. Dun & Bradstreet rating reveals capitalization in excess of $50 million and a desirable payment record.

9. Company C indicates that although they currently have Government owned facilities, they would not be required nor would addition facilities be contemplated for the performance of PF Program requirements.

10. Review of in-house procedures and systems in areas of Manufacturing, Production Control and Quality Assurance reveal (as a possible carry-over from ML&H) a complex series of checks and balances which will ultimately insure reliability and quality of products.

11. Managerial and supervisory talents are abundant to a point of possible impracticality and possible excessive cost for the needs of the PF Program.

12. In-depth reviews of Engineering, Procurement, Reliability, and Quality Control Programs reveal systems are adequate, if somewhat unwieldy.

13. DCASO has extended their approval of the ML&H Procurement System through 15 June 1973.

C. In summary, it is Company C's intent to handle PF Program follow ship requirement by tail-ending them with DD963 program requirements. It is considered that if DD963 deliveries were extended or PF lead time for follow-ship requirements shortened, it would create major parallel production, testing and delivery problems which would jeopardize the PF Program.

ENCLOSURE 2

BATH IRON WORKS
CENTRAL PROCUREMENT PROPOSAL

1. General Considerations

BIW has analyzed the advantages and disadvantages of Central Procurement and recommends that Central Procurement be utilized for selected PF equipment and components to reduce the acquisition and life cycle costs of follow ships.

Clearly, there are advantages and disadvantages of Centralized Procurement versus more traditional procurement practices utilized in the construction of earlier classes of destroyers. BIW has analyzed the two fundamental concepts, i.e., centralized vs. non-centralized procurement and concluded that the advantages of centralized procurement, if properly implemented in the PF program outweigh the inherent disadvantages of this approach.

In arriving at this conclusion, BIW material, technical and contracts personnel first evaluated noncentralized procurement. They determined the following:

- *Advantages* Noncentralized procurement might reduce delay risk costs by increasing the supplier base:
  - Risks would be spread to vendors in direct relationship to the number of units manufactured and more vendors would undoubtedly share risks.
  - Several vendors could supply equipment faster than one source - if necessary.
  - The PF Program at some premium in cost would support a broader industrial base - if this were required.
  - Once into the program, there might be alternative sources already producing any given equipment or system - if this is desirable or necessary.
- *Disadvantages*—Standardization would be reduced and material acquisition costs, procurement administration, engineering support and other non-recurring costs would be higher for the Navy, shipbuilders and vendors:
  - Under noncentralized procurement, participating shipyards would at times procure from common suppliers. Frequently, however, this would not be the case because of individual shipyard preferences and geographic locations.

- Where different vendors were used, material acquisition costs might rise, but most significantly Navy life cycle costs would increase.

- To maintain a degree of standardization, key systems or components would have to be furnished by the government or specified contractually. This would in effect place the risk of cost, schedule and performance on the government with minimum shipbuilder input.

- Less standardization of equipment as compared with the results of centralized procurement produces higher maintenance, repair and training costs for the Navy over the life of the ship.

- There would be costly duplication of effort with respect to purchasing, expediting, vendor quality assurance, vendor start-up costs, engineering and production.

- Some of the value of data passed from the lead yard to follow shipbuilders would be mitigated because different vendor sources could be used.

- Government approval, inspection time and costs would be increased.

Thus, while there are advantages and disadvantages of noncentralized procurement, it was concluded that the major advantages were not consistent with the principal "design to a price" objective of the PF program. On balance, central procurement is more attractive to the government, participating shipyards and vendors than is noncentralized procurement. Principal factors which support this conclusion are:

. Lower acquisition costs due to procuring in larger quantities

. Increased interest because quantity procurements are attractive to industry and invite competition.

. Reduced administrative costs due to the consolidation of several procurement actions.

. Simpler and more effective Navy program management.

. More standardization of equipment within class.

. Opportunity to make commitments before follow yards are selected.

Central Procurement, the process by which one organization procures material for multiple users, therefore is the recommended approach. The process includes reviewing purchase specifications, initiating requests for pricing, negotiations, supplier selection, order issuance, and purchasing function administration. The Central Procurement Agency

would procure specified equipment for Test use, Lead Ship, and Follow Ships. Central Procurement would coordinate the schedule requirements of all participating shipyards, together with the equitable distribution of all centrally procured material.

A material item which meets any one of the following criteria would be a candidate for a Centralized Procurement Plan:

- High cost
- Critical impact on production schedules
- Long lead time requiring procurement action prior to designation of Follow Yards
- Technical complexity
- Identified by Performance specifications
    - Requiring interpretive engineering
    - Requiring engineering interfaces among several suppliers
- Subject to potential cost growth through
    - Design change of development
    - Schedule change
- Requires a high order of standardization.

On the basis of prior Bath experience, it is estimated that 120 line items of equipment would meet these criteria for the PF and become candidates for Central Procurement. The value of these items would represent 50 per cent of the material cost of the ship. If central procurement is approved by the Government for PF these candidate items would be intensively reviewed to select specific equipment best suited for central procurement.

BIW has considered many central procurement methods. The BIW alternatives worthy of consideration are shown below. Alternative 8 is added only as a datum, to evaluate the other alternatives. Significant features of the alternatives are displayed in Exhibit II-20.

- *Alternative 1: The Government acts as Central Procurement Agency* and issues procured equipment to the participating shipyards as GFE.

- *Alternative 2: Shipyard A acts as Central Procurement Agency* and actually takes title to and issues procured equipment to the participating shipyards in accordance with their contractual production requirements. Follow shipyards would not include the centrally procured equipment costs in their proposal, since progress payments would be made to Shipyard A.

- *Alternative 3: Shipyard A acts as Central Procurement Agency, and negotiates an option for each participating shipyard* to purchase its own requirements in accordance with negotiated terms. The Government would approve Shipyard A's central procurement actions. Subsequently each shipyard would administer its own purchase orders and take title to its own equipment. The Government would accept follow yard material costs for centrally procured material to the limit established in Shipyard A's contract. Progress payments would be paid by the Government to each shipyard.

- *Alternative 4: A joint venture consisting of the participating shipyards* performs the Central Procurement functions as in Alternatives 2 or 3

- *Alternative 5: A separate company is subcontracted by the Government* to act as the Central Procurement Agency for the new PF Program.

- *Alternative 6: The Government or Shipyard A directs the sources of procurement* based upon lead ship experience.

- *Alternative 7: The Government directs the source of procurement* based upon current Government contracts.

- *Alternative 8: Each participating shipyard procures the equipment which he alone requires*. This is the usual noncentralized method of procurement, but is an alternative, and it is used in subsequent analysis as a datum upon which to evaluate other alternatives.

Review of the above alternatives indicates that some could be eliminated from further detailed analysis for this program. These are:

- *Alternative 1: Government acts as Central Procurement Agency*. This concept would involve the Government in the details of the procurement program and subject the Government to liability for problems of the Government furnished material. All procurement under this plan would be one step further removed from the using shipyards than any other alternative with attendant delays involving interface problems of engineering and schedule.

- *Alternative 4: A joint Procurement Agency of Participating Shipyards*. In the early phases of the PF Program, the follow shipyards will not be designated so

their participation would be impossible. This aspect negates any advantage of joint participation.

- *Alternatives 6 and 7: Government Directed Source.* These options can be applied by the Government to any material regardless of the nature of the Procurement method. Therefore, consideration of these options is not required to analyze the impact of a Central Procurement System.

The remaining Alternatives (2,3,5 and 8) have been compared to determine the most appropriate procurement method for the PF program. The following features of each alternative were rated with respect to the normal, noncentralized method (Alternative 8). Each feature was assigned a percentage weighting factor, as shown in Exhibit II-21.

The features of each alternative were evaluated with respect to the noncentralized method of procurement, and assigned a numerical value of 1 through 9 to indicate beneficial impact. On this scale, numbers less than 5 represent a negative effect, and numbers greater than 5 indicate a positive or desirable effect. The number 5 is neutral, indicating no difference or no impact on the desirability of the subject alternative compared to noncentralized procurement. To each of the assigned numbers the listed weighting factor was then applied. The sum of these weighted values represents the relative merit of the subject alternative with respect to the noncentralized method which is datum.

Experienced personnel of the BIW Material Division performed the evaluation described above. The results of this evaluation are displayed in Exhibit II-22 from the standpoint of the Government, a lead yard and a follow yard.

On the basis of the foregoing, central procurement alternatives appear more desirable from the point of view of the Government than they do to shipyards. This is due to the complexities and the risks involved in a shipyard operating a Central Procurement Agency. The Government however, will have only one procurement agent to manage and control instead of one for each shipyard.

The following specific conclusions can be drawn for each of the alternative procurement approaches examined:

- *Alternative 2: Shipyard A acts as central procurement agency* and takes title to material: this alternative

  - Provides excellent benefits to the Government by reducing costs and simplifying Navy Program Management. This alternative poses some risks to the Government, however, because a single contractor is responsible for very large committments.

  - Could be acceptable to the lead yard due to reduction of costs and simplification of management. The lead yard fee for this service would

EXHIBIT II-21
Features and Weighting Factors of Procurement Alternatives

Feature	Weighting Factors Percent
Recurring Acquisition Cost - Tends to reduce as quantity increases, but approaches zero cost change with very large quantity procurements.	25
Standardization - Affects program costs by: 1) increasing the opportunity for quantity procurements 2) reducing the number of procurement actions 3) reducing subsequent logistics support 4) permitting multiple courses where desirable to support production schedules or to inspire competition 5) simplifying Quality Control	20
Non-Recurring Acquisition Cost - Associated with design of equipment and the tooling for manufacture. These costs are to be applied to the Lead Ship.	10
Cost Growth - Unplanned increase in costs composed of high rate of escalation, design change by vendor or customer, schedule changes, and variations in engineering interpretation.	10
Delay Cost - Cost resulting from the non-performance of vendors. Impacts a Central Procurement Agency in the form of liability for delays incurred by the supported shipyards as the result of deficiency of the procured material in quality, performance, or delivery.	10
Cancellation Cost - Additional costs incurred as the result of a reduction in the quantity of the material contracted. It could result from a major design change of from a reduced number of ships in the PF Program.	5
Schedule Control - The ability to ensure the logistics support of ship production, and the support of program management. It requires interface with shipyards, suppliers, and the PF Program Office with respect to schedules and reports.	5
Quality Control - The ability to ensure the adherence of procured material to specified standards. Achieved by systematic inspection and tests of material, inspection and evaluation of vendors' facilities, and by the efficient administration of related records.	5
Administrative Cost - The costs of operating and supporting the procurement function. Includes personnel, facilities and equipment required to perform the tasks of specification review, supplier selection, negotiation, subcontracting, expediting, documentation, and reporting.	5
Profitability - The incentive for a private enterprise to do business. Of interest as an indicator of the manner which a particular alternative may be supported by the shipyards.	5
TOTAL	100

have to be high to compensate for the unusually high contractual responsibility with the attendant large financial risk involved in its role of supporting the follow yards.

- Is very attractive to the follow yards because of lower costs and and the assumption of risk by the lead yard.

. *Alternative 3: Shipyard A negotiates original contracts,* and *follow yards pick up option* for their own procurements: This alternative:

  - Provides benefits to the Government in the form of low costs and simplified overall program management at the beginning of the procurement. The Government receives full benefits from centralized procurement.

  - Is desirable to the lead yard because it has complete control over its own procurement, and realizes the benefits of central procurement. With the option clause, Shipyard A shares risks with follow yards.

  - Reduces follow shipyard procurement problems because all activities associated with initial committments are complete, yet control their procurements and assume responsibility upon exercise of the procurement options.

  - Increases equipment costs due to securing vendor options but reduces program costs due to reduced risk for Shipyard A.

. *Alternative 5: A separate company other than a participating shipyard is designated as central procurement agency*, and operates as in Alternative 3: This alternative:

  - Provides advantages to the Government in the form of lowered costs and simplified Navy program control. The interposition of an extra party between the Government and the participating shipbuilders detract from the advantages. The Government would not receive the benefits of having the lead shipbuilder using his Navy funded experience and acquired knowledge of PF to centrally procure critical equipment.

In conclusion, Bath recommends:

. That a form of centralized procurement be used for PF for high value, complex, or long lead equipment

. That the central procurement agency be a participating shipyard.

- Adoption of Alternative 3, which on balance appears to offer the best prospect of achieving PF objectives. During SSDS, however, a continuing analysis of Alternatives 2 and 3 with BIW and Navy participation would assure that the best central procurement method is selected.

- That during SSDS a plan for the administration of central procurement be developed. The plan would be evolved after detailed analysis of the aspects of cost, risk, and effective management. The plan would provide for the development of:

  - Terms and conditions to apply to subcontracts related to centrally procured material

  - An equitable policy governing the allocation of centrally procured material

  - An itemized list of material to be centrally procured

  - A reporting system to provide an effective management tool for control of the central procurement program

  - An approved method to share risks.

Based on the analysis done in preparing this proposal, BIW considers Alternative 3 to be the most attractive to the Navy and to participating shipyards in the PF program. The significant points of this alternative are:

- Shipyard A would be designated by the Government as the Central Procurement Agency.

- Shipyard A would, after receiving approval from the Government, negotiate subcontracts for the centrally procured items, with an option for the follow yards to pick up their requirements from the same vendor. Initial production schedules would be derived by Shipyard A with due consideration of the production requirements of all participating shipyards.

- Follow shipyards would be required by the government to exercise their options to pick up their part of the original subcontract and from that point would administer their portion of their own subcontract. They would be responsible for refining delivery schedules for their portion of the subcontract.

- Progress payments would be made by the government to each shipyard as its performance warranted.

- The government would accept material costs for all centrally procured material to be those quoted by Shipyard A.

The Alternative 3 method of central procurement will be acceptable to follow yards because:

- They will derive benefits of central procurement in the form of lower administrative costs and simplified management during the critical phases of the procurement.

- Risks will be equitably shared among all participating shipyards.

- BIW as central procurement agent will take advantage of experience gained during the design phase and lead ship procurement to reduce recurring and nonrecurring material costs.

The key to success under Alternative 3 is the confidence of the follow yards in the capability of the lead yard to perform in a satisfactory manner. Follow shipyards should have a high degree of confidence in BIW and its design subcontractor, because of their current destroyer expertise and past performance.

2. Application to Propulsion System Procurement

The Propulsion System of PF meets all the criteria for consideration as a candidate for central procurement. Its unique characteristics emphasize the desirability of central procurement of the system.

Bath estimates the cost of a PF Follow Ship Propulsion System at about $6 million. If not handled properly, the potential impact of delay on follow ships production schedules is massive, particularly for reduction gears, shafts, and propellers which must be assembled and installed prior to launch. This, with the impact of complexity, relatively long lead times, and limited number of qualified suppliers, cause BIW to propose central procurement of the propulsion system for follow ships. The following discussion is directed specifically to the propulsion system, but is generally in consonance with the BIW approach to central procurement recommended in the previous portion of this Section.

Bath recognizes that early procurement of long lead time items such as propulsion systems is as essential to follow ships as it is to the test unit and lead ship. Bath also recognizes that all feasible economies derived during test unit and lead ship experience must be reflected in the acquisition of follow ship units. The goals of Bath's approach to follow ship procurement are to:

- Provide equipment at the shipyards on or before scheduled dates.

- Minimize the cost of material

- Minimize risk to the Government and to the shipyards

- Minimize Navy administrative costs.

If authorized by the Government, and after award of an SSDS Contract, BIW will establish a Central Procurement Planning Organization which will:

- Develop a detailed plan for administering the procurement of follow ship propulsion systems, after thorough analysis of the aspects of cost, risk, and effective management.
- Develop terms and conditions for test unit, lead ship, and follow ship contracts.
- Develop a policy governing the equitable allocation of centrally procured propulsion system components to the participating shipyards.
- Develop a reporting system compatible with CDRL requirements which will permit effective control of suppliers' performance.

The plan and policy developed as above will be implemented during SSDS by BIW Procurement personnel supporting the design effort and procuring the test unit and lead shipset. (See Section Ie). These procurement personnel will:

- Direct and control all relations between potential suppliers and design personnel
- Develop lists of qualified suppliers
- Evaluate and approve, from the standpoint of procurement, developing plans for the propulsion system through participation in baseline reviews
- Develop and later refine test unit, lead yard, and follow yard schedule requirements for propulsion system components
- Originate Requests for Proposal from all potentially qualified suppliers
- Develop negotiating strategy which will include consideration of savings to be derived from test unit and lead ship experience
- After approval of the Government, subcontract for and release for manufacture specified equipment for propulsion systems
- Develop contingency plans for the procurement of equipment from alternate sources in the event of strike or disaster
- Allocate equipment to the participating shipyards after Navy approval.

The BIW approach to central procurement of follow ship propulsion systems in a quantity buy will minimize costs, and:

- Permit economical purchase of manufacturing time by reducing surges in demand caused by uncoordinated add-on procurements. Although some of the basic research of PF–type propulsion systems has been accomplished in prior programs, a learning curve will exist reflecting system integration, tooling, and start-up time. Significant savings can be expected as a result of quantity buys.

- Limit the cost of centrally procured service engineering. During negotiations, methods will be established which will segregate service engineering costs and avoid their hidden duplication in subsystem and component items.

- Reduce the costs of subcontract administration and enhance program control by passing CDRL requirements on to subcontractors in form and format.

- Reduce overall program procurement costs by combining the functions of several shipyards into one central agency for execution. Experience gained in test unit/lead ship procurement will be applied to follow ship procurements. Exhibit II-23 demonstrates the order of magnitude of savings possible for the propulsion system. The weighting factors reflect the relative expenditures required for lead and follow shipyards operating as individual procurement agencies as compared with a centralized procurement system. The dollar values shown are order of magnitude estimates for performing the listed functions for PF for SSDS. Test Unit, Lead Ship, and first block of Follow Ships.

BIW recognizes that the procurement of the follow ship propulsion system involves risks to the Government and to participating shipyards. These include technical risk, delay risks, and cost growth risks.

Technical risks include re-engineering, re-testing, re-tooling, and guarantee engineering. Technical risks are associated with program delays, contract changes, and retrofit. BIW will reduce these risks by ensuring the intimate participation of industry in design development. The same personnel buying for the test unit and lead ship will buy for follow ships under central procurement. Subcontracts will be structured to limit cost impact to those items affected by actual design change. Advantage will be taken of tooling and expertise developed during the test unit and lead ship production.

Delay risks result from nonperformance of suppliers in the areas of quality, performance, or delivery. In addition to costs resulting directly from defective equipment, each shipyard is faced with hidden internal costs associated with delays. Based on experience at BIW, these costs can be substantial. Delays in production cause serious schedule disruptions, need for creation of work-around plans, transfer of personnel to other work causing new learning curve and added cost of overtime to regain schedule.

Delays also affect the Government by jeopardizing the Nation's security by increased subsistence and other costs of naval personnel who are ineffectively used, and by the cost of extending the length of the entire program with its attendant administrative costs. Thus, any step that can be taken to avert delays will prove beneficial to all parties and keep the total program cost to the minimum. BIW will reduce the risks of delay to the shipyards and to the Government with the following strategy:

- Subcontracts for the Propulsion System for the test unit and Lead Ship will be negotiated as Firm Fixed Price. Fixed Price Incentive Fee subcontracts will be considered for follow ships. The incentive elements considered for inclusion in these subcontracts will be: cost, delivery, and reliability. Particular emphasis will be placed on those components which impact most heavily on ship production, the reduction gears, shaft, and controllable reversible pitch propellers.

- Subcontracts for propulsion system components will include negotiated milestones which will involve hardware, spare parts, testing, and Contract Data Requirements List (CDRL). These milestones will be used by the Central Procurement Agency to control progress payments, which will be keyed to performance and results, and not to effort expended.

- Subcontracts for propulsion system components will be negotiated to pass Quality Assurance/Control requirements to the subcontractor, and to require reporting levels of sufficient depth to ensure prompt visibility of any potential problems to the Central Procurement Agency. Corrective action will be initiated immediately.

- Subcontracts for propulsion system components may include provisions which will permit the use of tooling by alternate manufacturers at no cost in the event of schedule adherence problems. Lists of potential alternate sources will be generated during the supplier selection process to provide relief in case of strike or disaster.

- A pool of advance equipment will be produced which will be available as a cushion or hedge against strikes or other delays. This pool will be created by a production rate of propulsion system components greater than the initial ships' production rates.

- Bath procurement personnel will survey the facilities of propulsion system manufacturers before supplier selection to verify qualifications under MIL-Q-9858A. They will continue to inspect suppliers' facilities after award of subcontracts to ensure adherence to subcontracts and to obtain early warning of potential problems.

Cost growth risks are associated with changes in design, schedule change, or variations in engineering interpretation. They reflect the effects of a high rate of

escalation and the impact of change on a manufacturer's methods, tooling, and production time. BIW will limit the risk of cost growth by the following:

- Subcontracts for propulsion system components will have escalation clauses which bring escalation rates for components closely in line with Bureau of Labor Statistics escalation indices for steel vessels.

- BIW personnel who administer the subcontracts for propulsion system components will have participated in the design effort and baseline reviews, and will have procured lead ship and test unit equipment. The expertise gained thereby will minimize disruption which attends change. The Subcontract Administrators will be thoroughly familiar with the nature and background of the components of the system.

3. Budgetary Estimates for First Block of PF Follow Ships

Exhibit II-24 displays a time-phased estimate of budget requirements for the procurement of propulsion system major components for the first block of 24 PF Follow Ships.

The ordering and delivery schedule for the first block of follow ships is based upon Figure A-3 in the RFP. The following assumptions have been made:

- Central Procurement personnel will have participated in the design phase and will have negotiated prices, terms and the delivery for test unit and lead ship propulsion systems.

- Multiple manufacturers will have been identified to ensure the required rate of production, except for the gas turbine.

- Tooling will require only limited modification from test unit and lead ship production.

- A modern shipyard will require propulsion system components 6 months following commencement of fabrication.

Bath has determined that, following design and the production of the first unit, a production lead time of 15 months is required, and that a production rate of one shipset per month is reasonable at no premium cost. Allowing 16 months for start-up, production, and transportation, the first production block for follow ships should be released for manufacture not later than July 1975. Release for manufacture should be delayed until this date to accommodate any change which may be initiated as a result of experience gained from the test unit or lead ship unit. Exhibit II-25 summarizes the delivery schedule for propulsion system components for the first block of PF Follow Ships. It is noted that the production rate of propulsion systems equals the steady state rate of the scheduled ship production, providing a maximum of two shipsets on hand at each yard at any one time. This cushion will be utilized as a hedge against strike, disaster, damaged equipment or supplier slippage.

EXHIBIT II-20

Significant Features of Central Procurement Alternatives

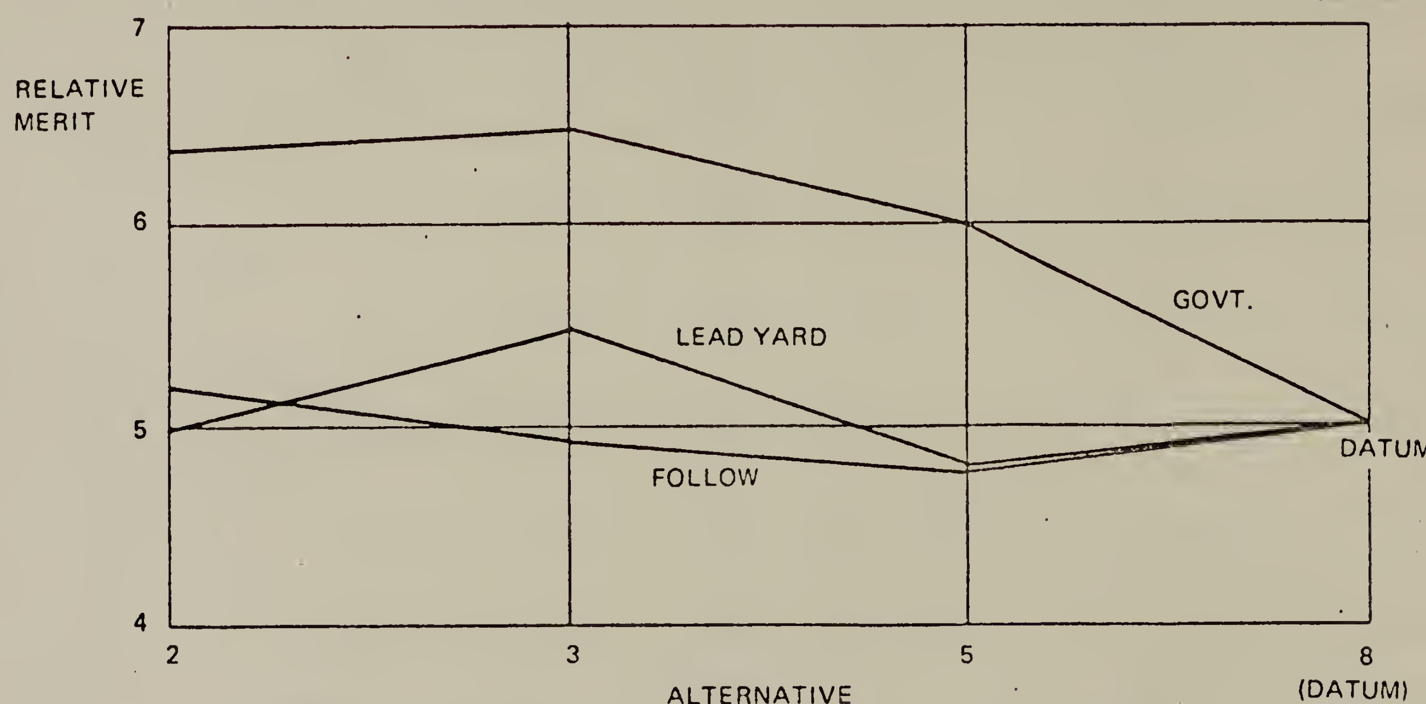
Alternate	Government	Shipbuilder A	Follow Yard
1 All GFE	- Has complete procurement responsibility - Accepts material technical, delay and cost growth risks of all participating shipyards	- Receive Material - Least Risk	- Receive Material - Least Risk
2 All CFE by Shipyard A	- Approves Shipbuilder A procurement actions - Accepts risk only if Shipyard A fails	- Manages Procurement - Receive Material - Most risk	- Receive Material - Minimal Risk
3 All CFE with Option to Follow Yards	- Approves Shipbuilder A procurement actions - Accepts risks only if shipyards fail	- Manage all Initial Procurements - Receive Material - Risk Shared by Follow Yards	- Contracts to Pickup Options and Manage Follow Procurement - Receive Material - Shares Risk with Shipbuilder A
4 All CFE Joint Venture	- Financially supports joint venture with progress payments - Approves procurement actions - Accepts risk only if joint venture fails - Commitments delayed until follow yards selected	- Manage Procurement - Receive Material - Risk Shared	- Manage Procurement - Receive Material - Risk Shared

EXHIBIT II-20 (Continued)

5 All CFE Separate Company	- Monitors procurement closely - Approves separate company procurement action - Accepts all risk costs	- Receive Material Procured by Independent Agent of Government - Minimal risk	- Receive Material Procured by Independent Agent of Government - Minimal Risk
6 All CFE Directed Source Based on PF Experience	- Specifies equipment to be bought - Accepts technical and delay risk of equipment not meeting performance or schedule requirements - Approves procurement	- Manage Procurements - Receives material - Medium Risk	- Receive Material - Least Risk
7 All CFE Directed Source by Government	- Same as Alternate 6		
8 No Central Procurement	- Has usual NAVSHIPS & SUPSHIP approval responsibility - Assumes least technical & delay risk costs	- Manage Lead Procurement - Receive Material - Medium Risk	- Manage Follow Procurements - Receive Material - Most Risk

EXHIBIT II-22

Evaluation of Alternative Procurement Approaches



ALTERNATIVE	GOVT	LEAD YARD	FOLLOW YARD
2	6.39	4.98	5.20
3	6.45	5.49	4.93
5	5.98	4.80	4.78
8	5.00	5.00	5.00 (DATUM)

EXHIBIT II-23

Benefits of Central Procurement of Propulsion System

Activity	Individual Shipyard Procurement					Central Procurement					Savings - $
	SSDS A	A	B	C	Total Expenditure - $	SSDS A	A	B	C	Total Expenditure - $	
Qualifying Vendor $30,000 = 1.0	1.0	-	1.0	1.0	$90,000	1.0	-	-	-	$30,000	$60,000
Design Agent/Shipyard/ Vendor Interface $100,000 = 1.0	1.0	.5	1.2	1.2	390,000	1.0	.5	.3	.3	210,000	180,000
Negotiations & Order Placement $30,000 = 1.0	1.0	.2	1.0	1.0	96,000	1.0	.5	.2	.2	57,000	39,000
Order Administration and Expediting $200,000 = 1.0	.2	1.0	1.0	1.0	640,000	.2	1.6	.2	.2	440,000	200,000
Configuration Mgt. $120,000 = 1.0	.1	1.0	1.0	1.0	372,000	.1	1.5	.3	.3	264,000	108,000
Total					$1,588,000					$1,001,000	$587,000
											37%

NOTE:

These are administrative cost savings only and are minor compared with potential hardware cost savings due to multiple-ship buys.

EXHIBIT II-24

Budgetary Estimates of Propulsion System Procurement for First Block of PF Follow Ships

Qtrs After 1972	6 Month Period	Est Cash Flow Percent for Period	Hdwre Unescalated ($000)	Assumed 3% Escalation ($000)	C-P Admin. Costs ($000)	Total ($000)
13	2-75 thru 7-75	2.25	2727	275	150	3152
15	8-75 thru 1-76	6.00	7272	853	150	8275
17	2-76 thru 7-76	9.50	11514	1542	100	13156
19	8-76 thru 1-77	13.25	16059	2422	100	18581
21	2-77 thru 7-77	16.00	19392	3257	100	22749
23	8-77 thru 1-78	16.00	19392	3595	100	23087
25	2-78 thru 7-78	16.00	19392	3937	100	23429
27	8-78 thru 1-79	16.00	19392	4284	50	23726
29	2-79 thru 7-79	5.00	6060	1449	-	7509
	Totals	100%	121200	21614	850	143664

Major Components Included: Engines
Reduction Gear
Clutch
Control System
Shafting
CRP

The budgetary estimate of cost of the propulsion system major components for the first block of 24 Follow Ships is $6,000,000 per shipset including escalation.

EXHIBIT II-25

Propulsion System Delivery Schedule
First Block PF Follow Ships

Ship	Start Fab.	Reg. Prop. Syst.	Del. Prop. Syst.
First Follow Yard (A)			
1	4/76	10/76	10/76
2	9/76	3/77	1/77
3	1/77	7/77	4/77
4	5/77	11/77	7/77
5	8/77	2/78	10/77
6	11/77	5/78	1/78
7	2/78	8/78	4/78
8	5/78	11/78	7/78
Second Follow Yard (B)			
1	5/76	11/76	11/76
2	10/76	4/77	2/77
3	2/77	8/77	5/77
4	6/77	12/77	8/77
5	9/77	3/78	11/77
6	12/77	6/78	2/78
7	3/78	9/78	5/78
8	6/78	12/78	8/78
Third Follow Yard (C)			
1	6/76	12/76	12/76
2	11/76	5/77	3/77
3	3/77	9/77	6/77
4	7/77	1/78	9/77
5	10/77	4/78	12/77
6	1/78	7/78	3/78
7	4/78	10/78	6/78
8	7/78	1/79	9/78

APPENDIX F

LEAD SHIP PRODUCTION CONTRACT CASE

A. BRIEF

This is a two part case dealing with the structuring decisions for the lead ship production contract for the Patrol Frigate (PF). This contract, while basically a production contract, has development characteristics because of the nature of lead ship production. The use of options and incentives are considered.

This part of the case deals, essentially, with long-range planning of the contract structure while the second part introduces a few of the more complex problems which had to be dealt with as the time of award of the contract approached.

It is recommended that students consider Part A of the case first and without knowledge of Part B. Once they are satisfied with their analysis of Part A, then the complications of Part B will present interesting sidelights into program management.

B. OBJECTIVES

The objectives for the student considering this case are:

1. To gain an understanding of the criteria on which contracts are based.

2. To gain an understanding of the interrelations of multiple-incentive contracts.

3. To examine tradeoffs which must be made among the various products' criteria for a production contract.

LEAD SHIP PRODUCTION CONTRACT CASE

PART A

A. BACKGROUND

Before discussion of the PF lead ship contract, a brief review of the overall procurement plan may be useful. Figure 1 shows the major acquisition phases that should be generally familiar. The Ship System Design (SSD) is being developed by NAVSEC, with technical assistance from the contractor, and defined in a series of four technical baselines. As seen in the PF PROCUREMENT PLAN, Figure 2, award of the lead ship production contract is made after the completion of the first three of these baselines. The fourth baseline, the Follow Ship Allocated Baseline (FSABL) will be established during production of the lead ship and with the assistance of the lead ship contractor.

The lead ship contract will then have eight products:

1. The Land Based Test Site (LBTS) - This is a prototype of the combat system and propulsion system built ashore to allow verification of proper integration and performance of these systems in an environment more controlled and less costly than aboard ship.

2. Tehcnical assistance in the production of the FSABL.

3. Centralized procurement agent for long-lead-time and other non-GFE items.

4. Production of the data package for follow shipbuilders (post-FSABL).

5. Production of the lead ship.

6. Development of software for the lead ship (QA, configuration control process, ILS manuals, T and E operations, etc.)

PATROL FRIGATE ACQUISITION PHASES

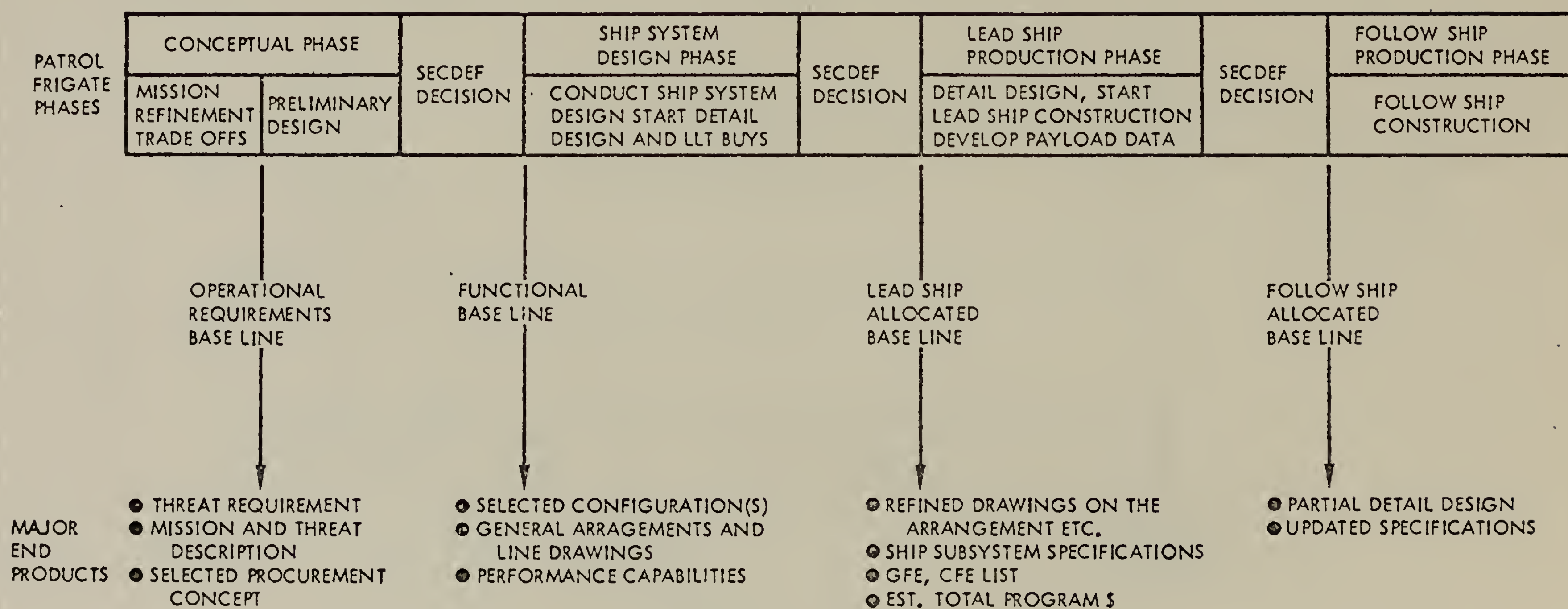


Figure 1

PATROL FRIGATE PROCUREMENT PLAN

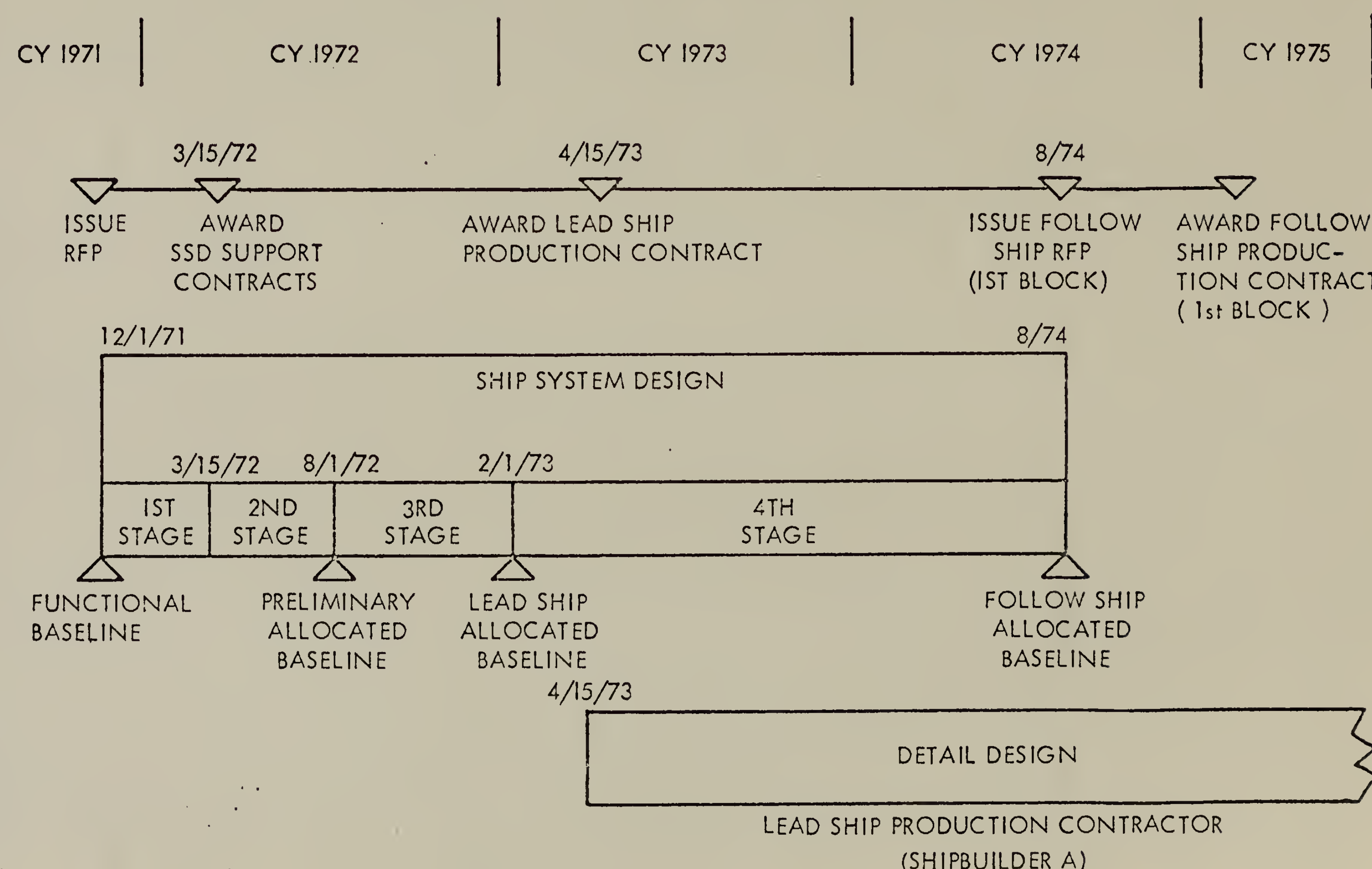


Figure 2

7. Design studies for proposed changes.

8. Technical advice on follow-ship procurement and problems.

For each of these products it is possible to develop criteria to which it is desired that the contractor perform other than merely cost under contract. Ideally, we could specify performance, cost, and schedule for any task and the contractor would meet all three. When these can't be easily specified in a contract, or when the contractors' resources are limited, it is desired that the contractor be responsive to the government's values on the goals or criteria. This generally is attempted through the use of incentives and specifications. For each product, main criteria for contractor performance have been derived and desired tradeoffs specified. These criteria and tradeoffs are schematically represented in Figure 3. An example of the interpretation for this diagram would be to consider PRODUCT 1, LBTS with design criteria Design Quality (Q), Performance of Prototype (P) and Timeliness (T). The expression $P, Q < T$ can be read, "if necessary the contractor should trade time in order to achieve a good propulsion design and demonstrate performance on the prototype, rather than meet the original schedule." The rationale for a tradeoff like this would be that undiscovered problems in the design of the propulsion for the lead ship will echo through all 50 ships and cause major slippages because of the necessity to change long-lead-time items. Also, there is a little slack in the schedule here if completed LBTS

FIGURE 3

PRODUCTS FOR LEAD SHIP CONTRACT

PRODUCTS	MAIN CRITERIA	DESIRED TRADEOFFS
1. LBTS a. Propulsion	Design Quality (Q) Prototype Performance (P) Timeliness (T)	$P,Q \leftarrow T; P \rightarrow Q;$ $\$ \rightarrow P,Q,T$
b. Combat Systems	Design Quality for Lead & Follow Ships (Q) Timeliness (T)	$Q \leftarrow T; \$ \rightarrow Q,T$
2. FSABL	Extent (E) Quality (Q) Timeliness (T)	$E,Q \leftarrow T; E \overset{?}{\leftrightarrow} Q;$ $\$ \rightarrow E,Q,T$
3. Centralized Procurement of LLT Items	Timeliness (T), Cost of Purchases (C) Design Quality (Q) Standardization (S)	$C,S,Q \leftarrow T;$ $\$ \rightarrow C,S,Q,T$ $S \leftarrow C; Q \leftrightarrow C,S$
4. Data Package	Extent (E) Design Quality (Q) Timeliness (T)	$T \leftarrow Q,E; E \leftarrow Q;$ $\$ \rightarrow T,E,Q$
5. Lead Ship	Cost (\$) Timeliness (T) Performance (P)	$T,P \leftarrow \$; T \rightarrow P$ if T less than 6 mos. & no slippage of DSARC III
6. Lead Ship Software	Timeliness (T) Design Quality for Follow Ships (Q)	$T \overset{?}{\leftrightarrow} Q; \$ \rightarrow T,Q$
7. Design Studies Changes	Quality (Q)	$Q \leftarrow \$$
8. Technical Advice	Quality (Q)	$Q \leftarrow \$$

testing is not required for DSARC III (Full-scale production decision). Finally, slippage here is less likely to exceed other slippages. The student should attempt to determine the rationale for each of the other tradeoffs in order to verify their validity.

The conclusions which can be made from examining the tradeoff for each product are that in general the government should be prepared for:

1. Trading money for quality of the design and data for the follow ships.

2. If necessary, trade time for quality of the design and data for the follow ships.

These conclusions are based on the present estimated schedule and the interrelationship of lead ship and follow-ships. These conclusions indicate that alternatives considered for the lead ship contract should encourage the contractor to develop a complete, producible design and should contain incentives (actually penalties) to limit the amount of transfer of cost and time from the follow ships to the lead ship.

Based on these conclusions the following three alternatives for the lead ship production contract have been developed:

1. A cost Plus Incentive Fee (CPIF) contract with cost and schedule incentives based on the lead ship itself.

2. A CPIF contract with cost and schedule incentives based on the lead ship plus an incentive of $.10/$1 below the target cost of the weighted average of bids from qualified follow ship builders. Escalation would be allowed. Target cost would be based on the programs objective for follow ships cost. This alternative will be called "CPIF + Bid."

3. A CPIF contract with cost and schedule incentives on the lead ship plus an option at the builder's discretion for four ships Firm Fixed Price (FFP) at $45 million minus GFM and lead-ship builder's savings. The option date would be six months before letting of follow ship contracts. Escalation would again be allowed. This alternative will be called "CPIF + Option." These alternatives are presented as a decision tree in Figure 4.

There are six basic criteria on which it has been suggested that the lead ship production contract are judged. These are enumerated now with the three alternatives ranked for each of them. They are:

1. Contractor motivation to reduce follow ship cost.

   In this case CPIF + Option is preferred to CPIF + Bid which is greatly preferred to CPIF. CPIF + Option has the strongest dollar reward to the contractor for low cost design.

2. Early information on likely cost of follow ships.

   Again CPIF + Option is preferred to CPIF + Bid which is greatly preferred to CPIF. The option price and contractors reaction will be available at the contract and option dates.

3. Risk of contractor windfall.

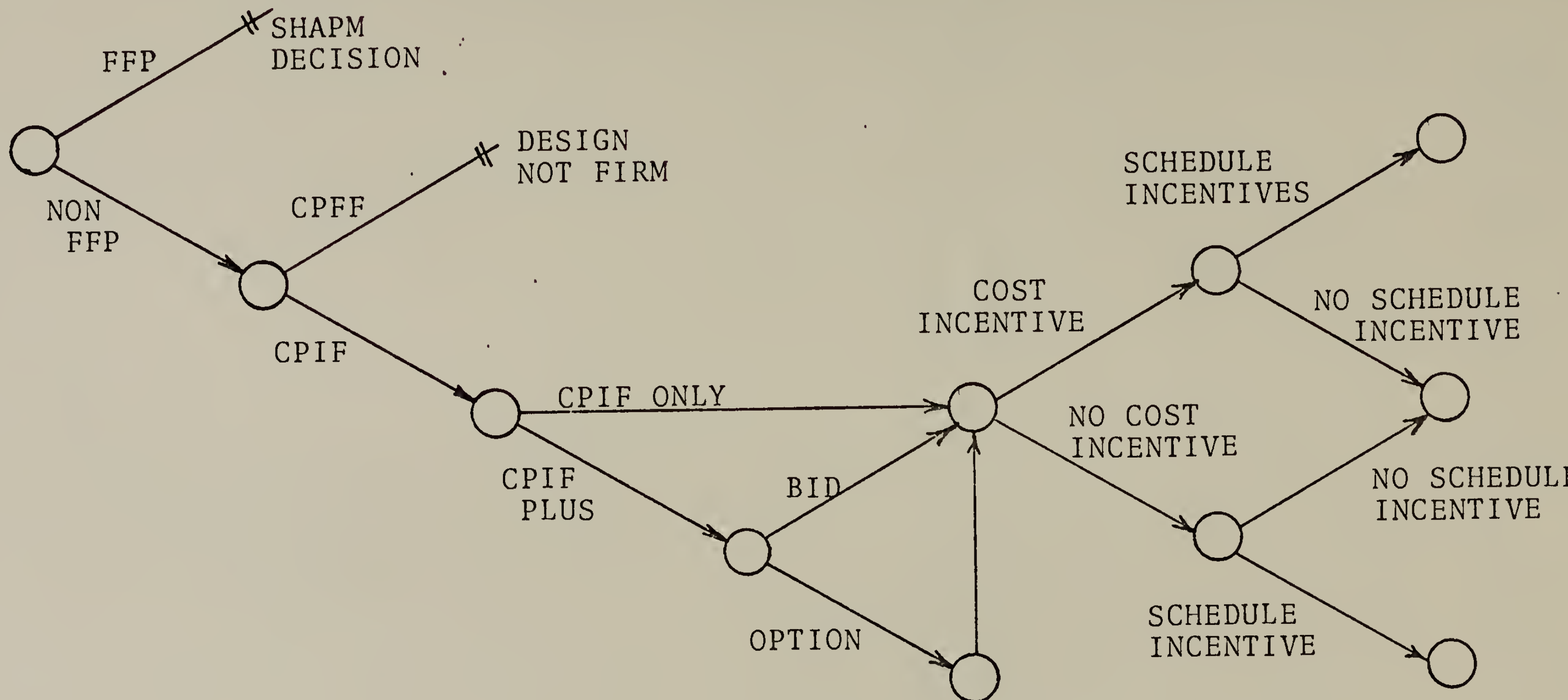
   CPIF is greatly preferred to CPIF + Bid which is preferred to CPIF + Option. CPIF + Option has a great chance of contractor windfall as does CPIF + Bid to a lesser degree.

4. Contractor motivation to bring leadship in on target.

   For this criteria all alternatives are the same. Performance with respect to target for the lead ship should depend on incentives which will be the same for all alternatives.

5. Government negotiating power for all ships.

   CPIF + Option is greatly preferred to CPIF + Bid which is preferred to CPIF. The CPIF + Option alternative, if chosen, would give the government a lever with the other yards.



DECISION TREE FOR LEAD SHIP PRODUCTION CONTRACT TYPE

FIGURE 4

6. Simplicity of administration.

Here, CPIF is preferred to CPIF + Option which is preferred to CPIF + Bid. The CPIF + Bid alternative could make it difficult to measure bid performance and may be more subject to disputes concerning charge orders.

These criteria should be considered in determining the structure of the lead ship production contract. There are, of course, many other criteria and reasonings which could play a part in the final decision.

B. REQUIREMENTS

The student should complete the analysis required and determine the structure for the lead ship contract. Share lines should be determined for incentives if incentives are used.

LEAD SHIP PRODUCTION CONTRACT CASE

PART B

A. ADDITIONAL BACKGROUND INFORMATION

During February 1973, the solicitation for the construction of the PF lead ship was assembled in preparation for forwarding to BIW. The earlier proposals for a lead ship incentive, as explained in Part A of this case had met with the following fate at the hands of NAVSHIPS 02B:

1. CPIF - Acceptable.

2. CPIF + Bid - The objective was deemed to be satisfactory. However, it appeared to 02B that the method put an incentive or penalty on a factor over which BIW had little effective control. There are many reasons (besides efficient design) which could influence competing shipbuilders proposal. The market place and its condition at the time proposals are received could have the most marked effect on follow-ship prices. A situation could easily result wherein BIW would be paid a substantial bonus simply because one or more competing shipbuilders submit "buy-in" or unreasonably low proposals. The Navy is already on the record as saying that the lead ship contract with BIW must be cost reimbursement type because they are not in a position to estimate a firm ship price.

3. CPIF + Option - Not recommended for many of the same reasons as above. How could a price for an option be negotiated prior to lead ship award? If this could be done, then the use of CPIF for lead ship construction should be questioned. Additionally, the award of a bonus ship to BIW contradicts the APP which indicated competition on all follow ships.

Included in the DATA section of this case are the memoranda by which the SHAPM, CAPT. Otth, submitted his ideas for the contract to NAVSHIPS 02 and NAVSHIPS 00J for review and comment and the resulting replies. These are included as illustrative examples of the manner in which these matters are handled within the Navy.

The failure of this incentive led the Deputy Project Manager to suggest another method which would tie the results of the lead ship construction to a low cost for the follow ships. He suggested the use of a weight or displacement incentive, reasoning that since a lighter ship usually costs less, rewarding Bath Iron Works (BIW) for this would result in saving money on the follow ships acquisition.

It appeared that there were five general areas of possible weight savings efforts by the contractor during design. These were:

1. Major redesign efforts for structural members, shell, foundations, shafting, rudder, etc., or rearrangement of machinery or superstructure to reduce foundations or stacks, etc. Here it would be possible to save $2-3 thousand per ton; but changes would be required to the contract in areas that are already thought to be well designed, in addition to creating a time problem.

2. Refined design of minor systems and non-structural members such as scantlings, floors, bulkheads, etc. to minimize material, welding, and foundations. Savings here would be on the order of $2-3 thousand per ton.

3. "Minimal requirements" design of the following subsystems:

a. Heating, ventilation and air conditioning.

b. Power and lighting distribution, outlets, control and flexibility.

c. Minimal distribution and control of "plumbing," fuel systems, compressed air, fire extinguishing, stores handling systems.

d. Minimal insulation, deck covering, cathodic protection.

e. Minimal noise, shock, EM protection, accessability, maintenance equipment handling.

f. Minimal habitability and environmental control.

Here the savings are higher, approximately $10 thousand per ton.

4. Substitution of lower-weight, but higher cost or lower durability materials, i.e., insulation, piping, wiring, paint, steel.

5. Weight savings which reduce producibility, i.e. elimination of metal by requiring machining, assemblies instead of castings, crowding equipment together, etc.

In order to assess the possible savings in using an incentive of this type, the information presented in Figures 5 and 6 was developed by NAVSHIPS 0161.

A second development in the lead ship structure contract problem was that several modifications made to the SSD contract had included many of the tasks originally listed for the lead ship production contract. The SSD contract of approximatley $5 million placed BIW in the role of supporting a design effort by NAVSEC. The contract was CPIF. Several modifications were made to this contract, most notably a large detail design modification and a less expensive propulsion modification. The detail design modification of the SSD contract was planned for over $20 million and contained activities of detail design, ILS, lead yard services to follow shipbuilders and the validation of the follow ship baseline data package. Figure 7 shows the results of modifications on the lead ship production contract.

Finally, at about this time, the question arose in the project office of what would happen if BIW was awarded follow ships. If this happened they would have both a CPIF ship construction contract for the lead ship and an FPIF (with escalation) contract for the follow ships at the same time.

FIGURE 5

PF COST FACTORS

AVERAGE FOLLOW SHIP
FY 1973 DOLLARS

WEIGHT GROUP TITLE	NUMBER	PF WEIGHT BY GROUP (TONS)	MANHOURS PER TON	MANHOUR DOLLARS PER TON	MATERIAL DOLLARS PER TON	TOTAL DOLLARS PER TON	TOTAL DOLLARS *
Hull	1	1126	212	1944	428	2372	2,670,872
Propulsion	2	259	236	2164	27118	31654	8,198,386
Electrical	3	168	592	5429	11162	16591	2,787,288
Communications	4	91	1159	10628	5108	15736	1,431,976
Auxiliaries	5	335	813	7455	7172	14627	4,900,045
Outfitting	6	248	611	5603	3534	9137	2,265,976
Armament	7	82	382	3502	4922	8424	690,768
		2309					22,945,311
Load		892					
		3400					

* Before Engineering Overhead and Profit

FIGURE 6

WEIGHT CONTROLLED BY LEAD SHIP BUILDER

	Tons Control	Tons Not Under Control	Tons Total
Group 1 - Hull structure (26% controlled)			1153
Under contract, or Guidance Contract Drawings - shell decks, etc.		856	
Not under guidance - bulkheads, etc.	190		
All other weight	107		
Group 2 - Propulsion (24%)			262
No control - turbines, gear, etc.		199	
All other weight	63		
Group 3 - Electric Plant (64%)			167
No control generators, swbds, etc.		64	
Cable and all other weight	103		
Group 4 - Communications (0%)		100	100
Group 5 - Auxiliary Systems (33%)			327
Diagramatic Guidance & Fluids		221	
All other systems	106		
Group 6 - Outfitting and Furnishing (?)			245
Group 7 - Armament (0%)		95	
Group 8 - Load (0%)		855	
	569	2390	3204

Not including outfitting, control is 569/2959 = 18%
Including outfitting as controlled, 814/3204 = 25%

Possible savings on controlled weight = 2-5%

Figure 7

RESULTS OF SSD MODIFICATIONS ON LEAD SHIP CONTRACT TASKS

TASKS (From Page 2)	RESULTS
1	Included as item under propulsion modification to SSD contract
2, 3, 4, 7, 8	Included as item under detail design modification to SSD contract
5	Remains for inclusion under the lead ship production contract
6	T&E plans and procedures and ILS included as item under detail design modification to SSD contract; other items are production related and remain for inclusion in lead ship contract.

B. REQUIREMENTS

1. What additional ways could BIW's lead ship activities reduce costs of the follow-ships not affected by the weight incentive?

2. Evaluate the use of a weight incentive as a feature of the lead ship production contract.

3. The detail design modification to the SSD contract contained an award fee. It was suggested that a weight incentive might be put in this contract. How could this be done? Consider: a) timing, b) measurement, c) award structure.

4. What are the difficulties which could be encountered if BIW is awarded follow-ships? How could they be avoided? Develop a plan for other lead ship contracts conversion to FPIF.

5. Originally the lead ship contract was to be an FPIF contract. What are the advantages and disadvantages for the proposed lead ship contract as represented by Figure 6? The FPIF would have standard shipbuilding escalation.

C. DATA

Enclosure (1): PMS 399 memorandum to SHIPS 02 and 00J: Advanced Planning for Lead and Follow Ship Procurement.

Enclosure (2): SHIPS 02B reply to Enclosure (1)

Enclosure (3): SHIPS 00J reply to Enclosure (1)

NAVSO 5216/5 (REV. 11-67)
S/N-0104-904-1762 (REV 11-67)

DEPARTMENT OF THE NAVY

Memorandum

PMS 399:ARD:cjf
PF
Ser 311-PMS399
29 June 1972

FROM : PMS 399

TO : SHIPS 02
SHIPS 00J

SUBJ : Advanced Planning for Lead and Follow Ship Procurement.

Ref: (a) NAVSHIPSNOTE 9110, 012:WHR:jec, ser 219-012 of 14 May 1971

Encl: (1) Analysis of PF Contract Incentive Alternatives

1. In planning for procurement of the lead and follow ships, PMS 399 has developed a number of new approaches that appear to hold promise for the PF program. Before developing the detailed implementation procedures for these approaches, your comments are requested. We would propose to present these approaches to SHIPS 09 and 00 for approval and to reflect them as necessary in forthcoming DSARC presentations and subsequent revisions to the PF APP and DCP.

2. Briefly, the approaches currently favored by PMS 399 are as follows:

a. PABL Review. Reference (a) requires that, "for major SCN Ship Projects, a final review and evaluation of the ship contract package shall be conducted by a review team headed by the SHAPM or his designated representive. The team shall insure that the package meets all the formally established operational requirements and the ship cost baseline, and is suitable for contracting purposes.... The contract package review team normally shall consist of representatives of OPNAV, NAVMAT, NAVSHIPS, NAVSEC, NAVORD, NAVSUP, NAVELEX, NAVAIR, and SUPSHIPS." It is our intent to convene this team at the Naval Observatory starting upon completion of the PABL in December, and to organize and conduct the

review in a manner similar to the PF SSDS source selection effort completed earlier this year. In accordance with reference (a), the team will consist of an Operational Suitability Group, a Business and Legal Group, and a Technical Group. The three Groups will report to the PF PABL Review Council, which will in turn report on the adequacy of the design and contract package to the CNM. It is proposed that the Council be chaired by COMNAVSHIPS, and be comprised of senior representatives from the system commands, PM 18, INSURV, and the fleet commands. The SHAPM would function as executive officer to the chairman and will be responsible for the detailed conduct of the PABL review.

b. Lead Ship Incentive Provisions. We have conducted various types of performance incentives that may be applied to the lead ship CPIF construction contract. We have concluded that an incentive on lead ship delivery would not be useful because timely lead ship delivery is not crucial to the program and, if stressed, could detract from other more important efforts under the lead ship contract. Incentive on performance in the areas of speed, displacement, reliability, silencing, or similar hardware-oriented parameters are also considered to be unwise for the lead ship contract because these items are only partially within contractor control and, in many cases, are in conflict with the major program goal of low follow ship cost. Because low follow ship costs is a major program objective, it is our conclusion that an incentive on follow ship cost is desirable, and can be developed to the mutual satisfaction of BIW and the Navy. We have explored two means of implementing such an incentive in the lead ship construction contract:

(1) Provide a payoff (or penalty) to BIW in proportion to the difference between a pre-established follow ship cost goal, and the average per-ship price of all competing shipbuilder's proposals to build follow ships. Or

(2) Include an option in the lead ship construction contract for one follow ship, at a price to be negotiated prior to lead ship contract award. This option could be exercised or declined by BIW in FY 75, based on their cost experience with the lead ship. If Bath exercised the option, the Navy would agree to award the second ship to BIW at the option price probably on a FPIF basis, if Congress and DSARC approved procurement of any follow

ships. Should BIW be awarded a contract for additional follow ships during competition, that contract would likely be combined ith the "option" ship contract. The advantages and disadvantage of these approaches are cited in enclosure (1).

c. Follow Ship Incentive. As noted in the PF APP, it is our intention to attempt to require follow ship configurations essentially identical to the lead ship. To achieve this, it will be necessary to require construction of the follow ships in accordance with detailed plans developed by the lead yard and provided by the Navy to the follow yards in accordance with a pre-established schedule. Each subsequent data package will be negotiated with the follow yards and will be contractually implemented as a result of a bilateral supplemental agreement. It is important that these bilateral change negotiations not be permitted to consider the entire follow ship contract structure and price each time a data package increment is added. To avoid that possibility, it is currently intended that the follow ship contracts be written such that the target cost may be adjusted as data increments are contractually invoked, but that the ceiling price will remain unchanged.

d. Central Procurement. Because of the rapid delivery rate of the PF follow ships (4 per year from each of three yards, delivery at 1 per month intervals), it has long been thought that some form of central procurement of major items could be advantageous, in that it would avoid the problem of having three yards compete with one for favorable scheduling from vendors of items common to all ships, and could eliminate duplication of procurement effort. In response to the RFP for Ship System Design, both BIW and Todd suggested that lead yard subcontracts for major items should include an option that may be exerised by follow yards. It is currently our plan to require BIW to procure propulsion system components in this manner; other major long lead time components (such as the diesel generators) are also being investigated for procurement in a simmilar way.

e. Joint Ventures (for Short Lead Time Items/ Material, not justifing Central Procurement as defined above). Because of the rapid deliveries of follow ships and the use of three building yards, it is expected that component vendors will have considerable difficulty in responding to the differing but nearly simultaneous demands of the three building yards, during the purchase/

negotiation cycle, and again at delivery. Similarly, there will be a large amount of duplication of effort among the three separate purchase activities of the three follow yards. For these reasons we plan to explore in some detail the feasibility of requiring the follow yards to enter into a joint venture for procurement of components and material for follow ships, and for the configuration management (and possibly data management) for same. Items suitable for procurement by a joint venture could include cables, piping, pumps, motors, fans, heat exchangers, and other items that are normally contractor furnished. Such an arrangement would most certainly assure a high level of standardization between follow ships, whould reduce follow yard purchase office costs, would require vendors to respond to only one customer in lieu of three, would simplify configuration management, and hopefully would obviate the otherwise likely need for Navy intervention to resolve conflicts between yards demanding identical delivery dates from the same vendors.

3. All of the above approaches require acceptance within NAVSHIPS, NAVMAT, OSD and industry to be sucessful, and to this end your comments are solicited. We are not seeking innovation for the sake of innovation, but do think that at least some variations of the above will be necessary to meet our very ambitious goal of delivering 12 identical ships per year for four years, starting in 1978. Any additional recommendations you may have would be welcome.

EDWARD J. OTTH

ENCLOSURE 2

NAVSO 5216/5 (REV. 11-67)
S/N-0104-904-1762 (REV 11-67)

DEPARTMENT OF THE NAVY

Memorandum

022:CMK:atg
Ser: 997-022
19 July 1972

FROM : SHIPS 02B

TO : PMS 399

SUBJ : Advanced Planning for Lead and Follow Ship (PF) Procurement; Request for Comments

1. Paragraph 2(a) is acceptable so long as the "Business and Legal Group" is intended to include the Contracting Officer.

2. Paragraph 2(b) has a satisfactory objective but both proposed methods are not recommended. Paragraph 2(b)1 seeks to put an incentive or penalty on a factor over which Bath Iron Works has little effective control. There are many reasons (besides efficient design) which could influence competing shipbuilders' proposals. The market place and its condition at the time proposals are received could have the most marked effect on follow-ship prices. We could easily wind up in a situation where we would give Bath Iron Works a substantial bonus simply because one or more competing shipbuilders submit "buy-in" or unreasonably low proposals. We are already on record as saying that the lead ship with Bath Iron Works must be cost type because we are not in a position to estimate a firm ship price.

Paragraph 2(b)2 is not recommended for many of the same reasons as above. How can we negotiate a price for an option prior to lead ship contract award? If anyone says we can then we should question the use of CPIF for lead ship construction. Furthermore, why are we talking about a bonus ship to Bath Iron Works at the same time that an APP is going forward indicating competition on all follow ships.

3. Paragraph 2(c) has been commented on previously. What would be the point of an FPIF arrangement with an

inflexible ceiling? Wouldn't it change to FFP when the target price approached or met the ceiling which it could easily do considering our normal number of specification changes?

4. Paragraph 2(d) is the same suggestion as we originally made in the early planning stages of PF. I consider it essential during the follow-on construction.

5. Paragraph 2(e) while this idea sounds good it has generally proved impossible to achieve. The same result can be achieved through establishment of planning yard procedures similar to what has been practiced on submarines. This provides for the planning yard ordering option quantities for follow yard material which follow yards may pick up at their election.

GERALD McBRIDE

ENCLOSURE 3

NAVSO 5216/5 (REV. 11-67)
S/N-0104-904-1762 (REV 11-67)
DEPARTMENT OF THE NAVY

Memorandum

26 August 1972

FROM : SHIPS 00J

TO : PMS 399

SUBJ : Advanced Planning for Lead and Follow Ship (PF) Procurement; Request for Comments

A judicious balancing of the Pareto principle with an innovative application of the Peter principle could motivate Bath to design the PF within the given restraints of the Program's "cost-to-produce" parameters without sacrificing the anticipated impact of the fall-out benefits of repeated application of increasingly meaningful exercise of parametric cost estimating techniques currently under development.

Recommend we wait for the forthcoming DoD handbook on the special "cost-response" program referred to on page 9 of VADM. Reich's article.

J. G. Smith

APPENDIX G

SHIP PROJECT DIRECTIVE CASE

A. BRIEF

This case investigates the role of the Ship Project Directive (SPD) in the management of a major ship acquisition project. The major aspects of NAVSHIPS SPD Instruction (7000.29B) are reviewed and summarized. Relationships between the Ship Acquisition Project Manager (SHAPM) and the Secondary Managers are discussed. Problems encountered with SHAPM primacy, reporting requirements, cost estimates and financial reports, funding deficiencies and changes, and timing of initial SPD preparation are cited. The student is required to analyze these problems and prepare recommendations for their correction.

B. OBJECTIVES

During investigation of this case the student should develop an understanding of:

1. The relationship between the SHAPM and Secondary Managers.
2. The SPD System Concept.
3. The SPD format.
4. The SPD implementation process.
5. The chronological development of the SPD.
6. Pertinent problems developing in the SPD System.

C. BACKGROUND

In its procurement efforts the Navy annually issues approximately three billion dollars of contracts to private suppliers. Guiding this purchasing are the many volumes of ASPR, the Armed Services Procurement Regulations, the efforts of the support commands, bureaucracies and the entire U.S. legal structure of laws and lawyers. Conflicts between supplier and purchaser have resulted despite this apparatus. In addition, the Navy, more so than other services, procures approximately one billion dollars worth of material from its own enginering and production organizations within the systems commands NAVORD, NAVSHIPS, NAVELEX, NAVSUP, NAVFAC, and NAVAIR. The situation is that the project manager must reach an agreement with the systems command for the procurement of GFM for the project. He wants a firm estimate of the cost for whatever function is being considered. The systems command wants to receive funding for developing and procuring the equipment which meets the required function, such as a fire control system. Before the first budget is formulated, the systems command and the project manager have had to agree that the system will be at least like the existing "Mark 204" fire control system, or no cost estimate can be given. But there are always questions about exact configuration and the integration of this component with the rest of the system. Therefore, the systems command personnel are not very willing to set a firm price at which they will perform their portion of the procurement. Thus, we have almost all the same

problems as with a procurement from the private sector. What replaces the ASPR, the procurement agencies and the legal system for these procurements?

The Ship Project Directive (SPD) System is the means by which Ship Acquisition Project Managers (SHAPM) authorize and direct the accomplishment of tasks to be performed in support of their ship projects. Since its inauguration 5 May 1969 nearly 400 SPD's have been signed and issued to Secondary Managers by SHAPM's. While still in its infancy the SPD System is firmly established as an on-going program and is a valuable tool of the SHAPM, providing him with better control over his project efforts.

The purpose of the Ship Project Directive System is to provide the machinery which permits the Ship Acquisition Project Manager (SHAPM) to assign tasks to a supporting agency, to give them the funds required to perform the tasks assigned, to obtain the supporting agency's commitment to provide the material or services specified, to control project funds, and to manage his project with improved effectiveness.

D. THE SPD SYSTEM CONCEPT

The concept of the SPD system as described in NAVMAT Instruction 7000.14A is as follows:

> "The concept of management for ship construction and conversion is to give the Ship Project Manager responsibility for managing all aspects of his Ship System as a complete entity. The Ship Project Manager will have the authority commensurate with his responsibilities to direct efforts and execute changes to effect completion of his project wherever required within the Naval Material Command. In carrying out his responsibilities he will utilize to the maximum extent the organizations in the Naval Material

Command to effectively use the expertise in specific functional areas of both administration and technology. In effect, these organizations, from the viewpoint of a Ship System, will support the Ship Project Manager in addition to carrying out their responsibilities for developing and producing common equipment and services."

The concept envisions the tasking of functional organizations to satisfy project needs, specifying feedback information required, and monitoring their performance, but does not authorize interference by SHAPM's in the internal matters of the supporting organizations.

The SPD itself is the official instrument by which the direction and authority for accomplishment of the planned project effort is promulgated by the SHAPM. It authorizes the Participating Manager (PARM) and/or Action Addressee designated by the PARM to initiate action to accomplish the tasks specified in the SPD at a total cost not to exceed the funds cited therein. It is the means by which the what and when of specified tasks are conveyed to the action addressees and by which the administrative funding limitations are established by the SHAPM.

E. SPD DESCRIPTION

A sample SPD is presented in enclosure (1). The Ship Project Directive consists of a Transmittal Page and three basic parts. The Transmittal Page identifies the Project and SPD, lists the current effective pages and their issue dates, provides a record of all modifications and record acceptances and authorizing signatures.

Part I (Management Direction) specifies objectives and requirements, assign responsibilities, establishes current project content, configuration and schedules, authorizes use of resources other than funds, and delineates special reporting requirements.

Part II (Funding and Quantity Direction) provides task description and/or identification of deliverables at the level funded, funding information, and other applicable accounting data and quantities, as required, for proper control.

Part III (Delivery Direction) provides configuration identification and calendar delivery dates for all deliverables listed (GFE, GFI, Test Support Equipment) under cognizance of the PARM and/or Action Addressee to which addressed.

The SPD is intended to cover a complete class of ship construction such as the Patrol Frigate, rather than a fiscal year's quantity of ships. It is imperative that PARM's be provided with as complete an understanding of this total effort as possible, and thus allow maximum planning of resources, maximum opportunity to capitalize on multi-year options or multi-year contracts, meaningful reporting, and effective management by the PARM on a project basis. To accomplish this goal, the SPD is designed to cover all ships to be built or converted to one basic set of plans and specifications, including acquisitions planned in future program years.

F. IMPLEMENTATION OF THE SPD

In accordance with NAVSHIPS instruction 7000.29B, the project issues as early as possible an SPD to every system command and some sub-organizations from which GFM is to be obtained. One project has issued 169 SPD's. No guidance is provided regarding optional time-phasing for SPD issuance relative to any key event. SHAPM's and Secondary Managers agree that pre-planning represented by issuance of "For Planning Purposes Only" SPD's should begin early. SHAPM's, for the most part, believe that pre-planning should begin at the time the Ship Characteristics are approved. Secondary Managers believe that pre-planning should begin at least 24 months prior to the Ship Project Program Year for advance procurement funding of ordnance equipment. Differences in procurement lead times account for these latter differences.

After the planned project effort (task) has been detailed and priced out on a basis acceptable to both the SHAPM and the PARM the SPD will be prepared to initiate execution of the agreed upon task. As an integral part of the total process, SHAPMs will be expected to provide PARMs with adequate information on which the PARMs can base their cost estimates. Conversely, the PARM will provide the SHAPM with sufficient information including citing comparative procurement documents to ensure that the SHAPM understands and agrees to cost estimates.

It is imperative to the proper functioning of the system that the PARM and the action addresses immediately proceed to initiate procurement and management actions defined in an SPD which has been signed by the SHAPM, whether or not the PARM agrees to the terms of the SPD. PARMs who disagree significantly with the tasks cost or delivery dates specified in SPDs should not sign the SPD. The PARM will not be held responsible for accomplishment within time or cost figures that he has not yet agreed to. However, when the SHAPM and PARM disagree on points that both parties consider minor, the PARMs should sign SPDs and record specific points of disagreement. Usually, the PARM has 21 calendar days commencing with the date of SHAPM signature to accept the SPD or to state in writing his reasons for rejection. In exceptional circumstances, the SHAPM may give the PARM up to an additional 21 calendar days. In the cases of rejection, the SHAPM must immediately notify the NAV MAT Project Manager (PM) that the PARM has submitted a written rejection and that the PARM will confer directly with the PM. If no PM is involved then the matter will go to COMNAVSHIPS for resolution. The PM/COMNAVSHIPS must act within 15 days to resolve the problem. Their decision is final unless within five days the SHAPM or PARM requests PM/COMNAVSHIPS to refer the issue to CNM.

It should be noted that PARM's have a right and a responsibility to question the validity of requirements, to state conditions which may limit their ability to comply with an SPD and to propose alternate courses of action to satisfy valid SHAPM requirements.

PARMs are not inclined to change existing systems and procedures to accommodate unusual SPD requirements. One reason for this is the difference in depth of reporting and reporting frequency requested by different SHAPMs. Reporting systems are not easy to develop and to change them requires time and resources. The need for change must be substantiated and the direction of change must be clear. This is not the case if inconsistent and incompatible reporting requirements are placed upon the PARM.

A chronological development of the SPD for the Patrol Frigate ship acquisition project is presented below. The SPD development is generally divided into four phases.

The first phase for purposes of our discussion is the preliminary planning phase. During this phase, the SHAPM organizes and staffs to develop a project master plan and begins the actions which will eventually lead to a completed ship.

The second phase is the SPD negotiating phase. An SPD is negotiated with NAVSEC during this period to obtain engineering or design services. Also during this period a proposed list of government furnished material (GFM) is prepared by the SHAPM in consultation with the PARMs. An SPD

is negotiated with each Secondary Manager to obtain the ship sub-systems under his cognizance. Some ship-subsystems are required early in the construction period or require a procurement lead time longer than the ship construction period. For this reason, the SPD's for ship-sub-systems must be negotiated (at least for known long lead time items) in advance of the program year in which the shipbuilding contract is to be awarded. In the proper sequence of events approved ship characteristics should lead to an approved list of GFM. This list should be used by the SHAPM to generate SPD's. From signed SPD's should come a firm Schedule A for the shipbuilding contract. An extract of a Schedule A is presented in Figure 1.

The third phase is the SPD execution phase. It is during this phase that the Secondary Manager takes action and reports progress. The SHAPM monitors progress and costs. Changes to SPD's are negotiated to reflect reality and to keep the SPD viable in a dynamic business environment.

The final phase is the retirement of the SPD. This occurs when all action has been completed and all funds have been expended or revised to require no further action and the remaining funds have been returned to the SHAPM.

SCHEDULE A

PATROL FRIGATE

PROPOSED GFE LIST

SWBS	QNTY	NOMENCLATURE	DESCRIPTION	ERI
4720	1	AN/WLR-8(V1)	ECM Receiver	- 10
4120	1	MK ( )	Signal Data Converter	- 10
4120	002	OU-194(V)3/UYS	Display Consoles (2 S and W)	10
4414	002	AN/URQ-10A	Frequency Standard	- 10
4720	1	AS-1023(MOD)/SLR	Antenna	- 10
4120	002	MX-3195/USQ-20	Keyset (ECM) (1 S and W Lamps)	10
4120	1	CV-2834/UYA-4(V)	Radar Video Processor	- 10
4120	1	AN/UYK-7	Weapon Control Computer	10
4120	1	OU-91(V3)/UYA-4(V)	Central Equipment Group	- 10
4120	1	TS-2490/UYK-7(V)	Maintenance Console Unit	- 10
4120	1	SB-2780/UYA-4(V)	Radar Distribution SWBO.(NTDS)	- 10
4120	1	ELECTRICAL EQUIP PACK	MT-4258/UYK	- 10
4120	14	DIGITAL DATA SWITCH	SA-1816/UYK	- 10

G. REQUIREMENTS

The student should analyze the operation of the SPD system and evaluate the effectiveness of the SPD system in achieving the results intended. Several problem areas affecting the operation of the SPD system are presented below. The student should analyze these problems and develop recommendations for correction of these deficiencies and improvement of the SPD system.

Problem 1: SHAPM Primacy

The concept of Project Management has a basic premise, that is, the Project Managers have complete control over the acquisition of their systems and their components. Numerous directives have established this fundamental policy. NAVMAT and NAVSHIPS Directives on the SPD System further define and strengthen the primacy of the SHAPM. Yet, there have been numerous instances where a Secondary Manager challenged the authority of the SHAPM by:

a. Refusing to provide procurement documents agreed upon in jointly signed SPDs.

b. Refusing to substantiate to the satisfaction of the SHAPM, cost estimates provided for the SPD.

c. Refusing to provide meaningful cost information in a manner required by the SHAPM.

Several factors of the Project Management environment may lead to these unsatisfactory occurrences. The more significant casual factors may be the command structure, the SHAPM's

relative rank, ignorance on the part of the SHAPM and low directed cost estimates.

Problem 2: Reporting Requirements

SPD's are vital to assure that SHAPM requirements, performance delivery dates and costs are acceptable to both parties. However, some Secondary Managers object to the detailed reporting requirements written into the SPD's and the depth of monitoring planned by some SHAPMs. The SHAPMs, on the other hand, believe they have the authority to require detailed reporting and the responsibility for monitoring the progress of the Secondary Manager's contribution to the Ship Acquisition Project. The result of this controversy sometimes is deadlocked negotiations or a Secondary Manager's refusal to provide documentation or reports specified in the SPD.

Secondary Managers do not have unlimited personnel resources. This is especially true for tasks which require large headquarters efforts which cannot be funded by the SCN appropriation. Therefore, unless the tasks can be accomplished through contractor services or unless the Secondary Manager is customer-funded, more money from the SHAPM will not provide additional mandays. A frequent example of this is the placement of excessive reliability, maintainability, and availability requirements on the PARM by the SHAPM.

Problem 3: Cost Estimates and Financial Reports

While some SHAPM's report a lack of confidence in cost estimates by Secondary Managers in general, the basis for cost estimation identifiable to specific historic contractual documents are readily available for estimates received from some Secondary Managers. The Project Document Report, issued monthly by the Naval Material Command Support Activity, lists contracts issued by these Secondary Managers with status of commitments and obligations. Previous issues of this report are readily available. Other Secondary Managers publish the Program Director's Report (PDR) weekly. This report is identifiable with items listed in their Chart of Accounts. The Chart of Accounts combines for each SPD line item all commitments and obligations involved on a cumulative basis. These PDR's are forwarded to the SHAPM.

Most of the SHAPM's commenting on this topic consider the PDR, if used for verification of cost estimation, as being insufficient for proper verification of costs proposed by certain Secondary Managers. The reason for this is that there is no visible track established between costs shown on certain Charts of Accounts and the basic contract contributing to the costs depicted on the PDR. Further, it is difficult for the SHAPM to correlate the percentage of work completed with the amount of dollars spent. All costs charged to a SHAPM must be specifically identified to contracts and other financial documents originated by a Secondary Manager, since headquarters personnel are chargeable to the O&MN Appropriation, not to

the SHAPM's SCN and R&D project funds. The SHAPM must have the assurance that only those charges legitimately chargeable to his project are, in fact, made. He can do so only by direct tracking with the specific contractual and financial documents establishing these charges, and with the specific bases developed by the Secondary Manager for cost estimating.

Problem 4: Reporting Fund Deficiencies and Changes

The NAVSHIPS SPD Instruciton (7000.29B) permits the SHAPM to specify line-item level of cost control for some SPD items as well as control at the total directed dollars level. The estimated cost of any line item marked by an asterisk (*) in Part II of the SPD may not be exceeded without prior approval of the SHAPM. This is true even though the total directed dollar amount may not be exceeded. On other items the SHAPM must be notified within five working days when the line item cost estimate has been exceeded.

One Secondary Manager reported that 50 financial changes occurred within a 30-day period. These resulted from various causes including inflation, modifications, market conditions, and quantity changes. A price change of one equipment may effect SPD's from more than one SHAPM. Procurements are based upon total equipment requirements, not on line items within an SPD. Equipment procurements are spread over time and, therefore, at the time the increase in cost of one equipment is known other equipment costs are yet uncertain. A review of all SPD's that require a particular item, to determine what other equipment procurements must

be considered and a corresponding review of those equipment procurements to determine if an overrun is likely, becomes a large clerical effort. Some Secondary Managers complained that resources are not available to perform this analysis for each procurement request processed. SHAPM's indicated that they were not receiving the analysis reports required by the NAVSHIPS instruction.

Everyone agrees that SHAPM's should be notified as soon as it appears likely that an overrun will occur. The foregoing discussion indicates, however, that Secondary Managers are unable to clerically review and analyze SPD's to report financial status as each procurement is processed. Until this analysis can be accomplished through ADP processes, another method of review is required.

Problem 5: When Should SPD Preparation Begin?

The initial implementation planning for the SPD System required the SHAPM's and Secondary Managers to complete SPD negotiations for the Fiscal Year 1970 Program by 1 July 1969 and for prior Fiscal Years 1964-1969 by 1 July 1970. There was no formal plan at the NAVSHIPS level for accelerated preparation of subsequent program year SPD's to bring about negotiation of an SPD at a point two years before the commencement of the program year. In August 1970, few SPD's had been received by Secondary Managers for the Fiscal Year 1971 program. The absence of SPD's early in the planning process means that (1) Secondary Managers are getting requirements and funds for long lead time items through a

different system, (2) The SPD is reduced in stature to a recording device for previous decisions, and (3) duplicate work is required to keep the two systems synchronized. The SPD System cannot reach its full potential until it becomes the singular document for placing requirements on the Secondary Manager and the Secondary Manager's key source document for planning and procuring.

Under ideal conditions a list of proposed government furnished material (GFM) should be prepared early in the project planning phase. Once approved, this list should be the basis for preparing an SPD for each of the Secondary Managers. The SPD should form the basis for RFP/IFB and contracting purposes by the PARMs. Under present SPD processing conditions the SPD's are not prepared until relatively late in the project. This means that GFM decisions are being made outside of the SPD System. Long lead time material is being budgeted for and financed without a covering SPD.

NAVAL SHIP SYSTEMS COMMAND HEADQUARTERS
SHIP PROJECT DIRECTIVE
(CONTINUATION SHEET)

BODY OF PART I - FORMAT GUIDE

Reference: (a)
(b)

1. Information:

Background and basis for issue of Ship Project Directive, should include definition of total ship program.

2. Action:

a. Management

(1) Configuration Management

The Project's policy on changes to GFE should be expressed. In addition, the PARM's participation in controlling the configuration of contractor furnished equipment under his technical cognizance should be spelled out explicitly or by invoking some other document.

(2) Data Management

Define the PARM's participation in the establishment of data requirements, and in the acquisition, collection, distribution, filing, retrieval, and updating of data for the ship class.

(3) Security

Invoke the security guidance covering the particular ship design.

Require the PARM to provide guidance on classification of equipment and subsystems for which he is responsible.

(4) Cost and Schedule Management

If any requirements beyond normal Quarterly Production Progress Conference (QPPC) routine progress reporting and standard controls are to be employed, these should be spelled out.

(5) Software appraisal

PARM review of TDP's, PMP's, contract proposals, and other across-the-board software not tied to particular discipline or subsystems should be spelled out here.

SUBJECT	DATE	SERIAL REV. NO.:

ENCLOSURE (1)

(6) Delegation of Authority to the PARM by the SHAPM

It may be desirable to require the PARM to act for the SHAPM. For example, it is possible to delegate to him approval authority for some technical documentation provided by the shipbuilder. The extent of the delegation and the means through which it is to be exercised, should be spelled out here.

(7) Required Membership on Committees, Boards, etc.

In addition to the SHAPM Project Change Control Board, the SHAPM may establish other committees and teams requiring PARM representation. Any such committee type actions should be listed here, although details on how they function may be handled in other portions of the SPD.

b. Ship System Engineering

(1) Whole Ship Studies

The scope of support by the PARMS must be spelled out for each ship project.

(2) Ship Systems Integration

The contribution of the PARM should be stated, and any constraints which he must comply with must be invoked. For example, if the integration of the combat system is to be done in accordance with some plan which sets physical parameters, casualty philosophy, and so forth, that plan must be invoked.

(3) Ship Systems Safety Engineering

PARM support required to review ship designs for safety aspects should be defined and applicable sections of MIL-STD-882 should be utilized as a guide.

(4) Quality Assurance

The QA requirements should be placed here. The level of essentiality of the equipment should be invoked here, by reference, if desired.

(5) System Test and Evaluation

Documentation which the PARM is required to provide as an input to the formal ship test program should be defined. His personnel support in this area should also be laid out.

SUBJECT	DATE	SERIAL REV. NO.:

ENCLOSURE (1)

(6) Installation and Check-out

The extent of documentation and personnel support to be provided for installation and check-out of equipment and subsystems should be spelled out. This is particularly important in the case of complex systems such as missile systems, where a special team may be put together to check-out a system comprised of equipment furnished by several Systems Commanders.

(7) Design Work Study in Shipbuilding

Place a requirement on the PARM to establish the manning requirements for the hardware system or equipment he is responsible for (or the ship design in the case of NAVSEC), together with the supporting documentation showing how the operational and maintenance requirements were arrived at.

(8) Human Engineering

The extent of human engineering to be carried out should be described. For example, a system which requires a very rapid response, like a threat-reactive missile control, may require an end-to-end human engineering study to insure that human time lag and error do not subvert its intent. What support is expected of the PARM in such a study should be spelled out.

(9) Risk Management

The SHAPM is required to identify risks and to have a Risk Management Plan to control them. The actions which he requires of a PARM to assist in preparation of details and execution of the Risk Management Plan should be spelled out here. For example, if a special analysis by the PARM is required to permit a decision as to whether some risk item will be used or a fall back will be employed, the analysis should be called out here.

(10) Engineering Interface Standards for Shipboard Systems and other Constraints

The interface requirements and constraints to be invoked for a system to be installed aboard ship should be defined to the PARM. Existing Engineering Interface Standards should be invoked here.

c. <u>Equipment Engineering/Production Standardization</u>

(1) Component/Equipment Standardization-state or reference the standardization objectives of the project; for example, all equipments of all ships of the class identical; all computers employed to be AN/UYK-7; not over 10% of equipments to have new CID numbers; and so forth.

SUBJECT	DATE	SERIAL REV. NO.:

ENCLOSURE (1)

Provide guidance to the PARM on the steps to be taken to insure that out-year ships will have equipment identical with current year ships, and specifically cover the issues of multi-year equipment procurement, standardization D&F's, options and advance procurement.

(2) Reliability Engineering

Advise the PARM what his reliability engineering requirements are and under what conditions they are to be achieved. This will probably have to be done by invoking the appropriate reliability engineering military standard, instruction, etc.

(3) Maintainability Engineering

Any special maintainability requirements to be met by the equipment should be called out here.

The provision of MEAR's for use in the ILS project will be covered under the heading of Integrated Logistic Support (paragraph d. below).

(4) Signature Engineering

Any special requirements on equipment silencing, magnetic signature, or electromagnetic radiation signature should be called out here.

(5) Equipment Safety Engineering

PARM support required to review equipment for safety aspects should be defined.

(6) Engineering Interface Standards for Equipment and other Technical Constraints

Place a requirement on the PARM to invoke Engineering Interface Standards in the procurement specifications for new equipment.

(7) Specific Actions to be taken by the PARM on Contractor Furnished Equipment Under his Technical Cognizance

In some cases, the shipbuilder is developing equipment which would normally be provided as GFE. In such cases, assistance should be obtained from the cognizant NMC PARM to insure that it is properly developed, and where appropriate, service approved.

(8) Equipment Installation and Check-out

SUBJECT	DATE	SERIAL REV. NO.:

Documentation and assistance to be provided for installation and check-out of GFE should be spelled out here.

d. Integrated Logistic Support

PARM support required to formulate the Ship Project Integrated Logistic Support Plan should be defined. Application of Logistics Support Analysis techniques (NAVMATINST 4000.20, current version) in hardware acquisition and the extent of the application of ILS by the PARM should be described.

e. Special Government Furnished Information (GFI) Requirements

NAVSEC may be required to develop a list of GFI, obtain concurrence that it is adequate from the cognizant SUPSHIP, schedule it, obtain it, and deliver it. This covers not only GFI furnished with hardware but other GFI where required. (Note: Where GFI is to be delivered separately and will be so cited in a Ship Contract schedule, it will be listed in Part III, Section B.)

3. Schedule

Pertinent dates (Note: GFM dockside or equivalent delivery dates will be shown in Part III.)

4. Shipping Instructions

As appropriate

5. Special Instructions

As appropriate

6. Reports

Specify required reports

7. Format Guide Statement

In preparing this Part I, the SHAPM has reviewed and considered each area of the Format Guide for applicability. Therefore, any area not cited above is considered not applicable to this SPD.

SUBJECT	DATE	SERIAL REV. NO.:

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8430	1 APRIL 1969	377F0006	4

ITEM NO. SPD	ITEM NO. CONTRACT SCHEDULE	BUO PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION QTY	CURRENT DIRECTION DOLLARS	CHANGE TO PREVIOUS DIRECTION QTY	CHANGE TO PREVIOUS DIRECTION DOLLARS
1	A16	82	418	Radar System AN/SPS-10F	300,000				
2	A18	82	418	ECM System	500,000				
3	A19	82	418	Misc. Elex. Equipment	100,000				
				TOTALS	900,000				

NOTE I: Refer to Part III for detailed configuration and equipment breakdown.

FOR ADVANCE PLANNING ONLY

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
COMNAVSEC *	As required*	LHA 1 Class FY 1970 Procurement*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8420 (ORD-1720)	1 OCTOBER 1969	378J0002	3

ITEM NO.		BUD PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION		CHANGE TO PREVIOUS DIRECTION	
SPD	CONTRACT SCHEDULE					QTY	DOLLARS	QTY	DOLLARS
1	A7	8210	911	Combined Launch System MK26 MOD 0	1,800,000	1	1,800,000	-	-
2	A8	8213	911	Gun Fire Control System MK86 MOD 2	1,900,000	1	1,900,000	-	+200,000
3	A11	8212	911	5"/54 Light Weight Gun MK45 MOD 0	2,100,000	1	2,100,000	-	-300,000
				TOTALS	5,800,000		5,800,000		-100,000
				Current direction provided by Program Funding Authorization No. 28911, Amend. No. 2					

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
COMNAVORD*	As required*	DLGN 38 CLASS FY 1970 PROCUREMENT*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8430	1 APRIL 1970	393Z0003	1

ITEM NO. SPD	ITEM NO. CONTRACT SCHEDULE	BUD PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION QTY	CURRENT DIRECTION DOLLARS	CHANGE TO PREVIOUS DIRECTION QTY	CHANGE TO PREVIOUS DIRECTION DOLLARS
1	A5	82	412	Communication System	1,000,000	1	1,000,000	-	+200,000
2	A9	82	412	IFF System	100,000	1	100,000	-	-
				TOTALS	1,100,000		1,100,000		+200,000
				Funds available for obligation.					

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
COMNAVELEX*	As required*	SSN 688 CLASS FY 1970 PROCUREMENT*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8420	1 MARCH 1970	378N0004	-

ITEM NO.		BUD PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION		CHANGE TO PREVIOUS DIRECTION	
SPD	CONTRACT SCHEDULE					QTY	DOLLARS	QTY	DOLLARS
1	A12	28	521	D-2G Nuclear Propulsion Plant	20,000,000	2	20,000,000	-	-
				TOTALS	20,000,000		20,000,000		
				Funds available for obligation.					

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
SHIPS 08*	As required*	DLGN 38 CLASS FY 1970 PROCUREMENT*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8420 (AIR-1920)	1 MARCH 1970	392R0001	8

ITEM NO.		BUD PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION		CHANGE TO PREVIOUS DIRECTION	
SPD	CONTRACT SCHEDULE					QTY	DOLLARS	QTY	DOLLARS
1	A23	8113	931	Catapult C-13 MOD 1 System	3,000,000	2	3,000,000	-	+100,000
2	A24	8114	931	Arresting Gear System, MK7 MOD 3	2,000,000	4	2,000,000	-	-200,000
3		8120	931	PLAT System	150,000	1	150,000	-	-
				TOTALS	5,150,000		5,150,000		-100,000
				Current direction provided by Program Funding Authorization No. 38931, Amend. No. 1					

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
COMNAVAIR*	As required*	CVAN 68 CLASS FY 1970 PROCUREMENT (CVAN 69)*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/4 (1-72)

SHIP PROJECT DIRECTIVE - FUNDING AND QUANTITY DIRECTION - PART II

APPROPRIATION	SUBHEAD	DATE	SPD NO.	REV. NO.
17X1611	8426	1 MAY 1969	38OQ6005	4

ITEM NO.		BUD PROJ/ PROGRAM ACCOUNT	COST CAT. CODE	ITEM DESCRIPTION	PLANNING ESTIMATE $	CURRENT DIRECTION		CHANGE TO PREVIOUS DIRECTION	
SPD	CONTRACT SCHEDULE					QTY	DOLLARS	QTY	DOLLARS
1	A14	10	428	Hull Mounted Sonar Sys. AN/SQS-26CX	2,000,000	1	2,000,000	+1	+2,000,000
2	A15	10	428	VDS Sonar Sys. AN/SQS-35V	1,000,000	1	1,000,000	-	-
3#	A18	10	418	Underwater Communication Sys. AN/WQC-9 NOTE I:	500,000				
3	A18	10	428	Underwater Communication Sys. AN/WQC-2 (Fallback Decision Date - 7 June 1972)	500,000			-	-
				TOTALS	3,500,000		3,500,000		+2,000,000

NOTE I: The UW telephone AN/WQC-9 has not been service approved. The AN/WQC-2 is designated as the fallback equipment in the event that service approval is not obtained in time to permit procurement of the AN/WQC-9.

Current Direction provided by Program Funding Authorization No. 22731, Amend. No. 2

ACTION ADDRESSEE	INFO ADDRESSEES	SUBJECT
SHIPS 90*	As required*	DE 1078 CLASS FY 1966 PROCUREMENT*

* Must be the same as the Transmittal Page

Enclosure (1)

NAVSHIPS 7000/5 (1-72)

SHIP PROJECT DIRECTIVE - SCHEDULE - PART III

SCHEDULE TYPE (Check Appropriate Schedule Described Below)

[X] GFE DEL. SCHED. [ ] TEST SUPPORT EQUIP. DEL. SCHED. [ ] * GFI DEL. SCHED.

DATE 8/19/69 | SPD NO. 389JX006 | REV. NO. 1

ITEM NO. SPD	ITEM NO. CON-TRACT NO.	* DOC NO. (*Use For GFI DEL SCHED. ONLY)	EQUIPMENT DESCRIPTION or * DOCUMENT DESCRIPTION (*This column Indicates Document Description If GFI DEL. SCHED. Checked Above)	QTY PER HULL	HULL NUMBER FY 1970 (6) (7) 963	FY 1970 964	FY 1971 965	FY 1971 966	FY 1972 967	FY 1972 968	FY 1972 969
(1)	(2)	(3)	(4)	(5)	(8)						
1	5		Guided Missile Director MK 76/0	1	1/10/71	4/20/71	1/10/72	4/20/72	5/25/72	1/10/73	3/15/73
2			Junction Box MK 76/0	1	1/30/71	5/10/71					
3	7		Fire Control Panel MK 285/0	V					1/5/71 (2)	4/15/71 (1)	
4	21		Junction Box MK 50/0	V					1/5/71 (2)	4/15/71 (1)	

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Enclosure (1)

NAVSHIPS 7000/5 (1-72)

SHIP PROJECT DIRECTIVE - SCHEDULE - PART III

SCHEDULE TYPE (Check Appropriate Schedule Described Below)	DATE	SPD NO.	REV. NO.
☐ GFE DEL. SCHED. ☐ TEST SUPPORT EQUIP. DEL. SCHED. ☒ * GFI DEL. SCHED.	8/19/69	389JX006	1

ITEM NO. SPD	ITEM NO. CONTRACT NO.	* DOC NO. (*Use For GFI DEL SCHED. ONLY)	EQUIPMENT DESCRIPTION or * DOCUMENT DESCRIPTION (*This column Indicates Document Description If GFI DEL. SCHED. Checked Above)	QTY PER HULL	HULL NUMBER FY 1970 (6) (7) 963	964	FY 1971 965	966	FY 1972 967	968	969
(1)	(2)	(3)	(4)	(5)	(8)						
1	1	XXXXX	Mark 60 Tech Manual	1	1/10/71	4/20/71	1/10/72	4/20/72	5/25/72	1/10/73	3/15/73
2	4	XXXXX	Installation Drawing	1	1/30/71	5/10/71					
3	5	XXXXX	Installation Drawing	V					1/5/71 (2)	4/15/71 (1)	
3a	20	XXXXX	Installation Drawing	V					1/5/71 (2)	4/15/71 (1)	

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Enclosure (1)

NAVSHIPS 7000/5 (1-72)

SHIP PROJECT DIRECTIVE - SCHEDULE - PART III

SCHEDULE TYPE (Check Appropriate Schedule Described Below)

☐ GFE DEL. SCHED. ☒ TEST SUPPORT EQUIP. DEL. SCHED. ☐ * GFI DEL. SCHED.

DATE: 8/19/69 | SPD NO.: 389JX006 | REV. NO.: 1

ITEM NO. SPD	ITEM NO. CON-TRACT NO.	* DOC NO. (*Use For GFI DEL SCHED. ONLY)	EQUIPMENT DESCRIPTION or * DOCUMENT DESCRIPTION (*This column Indicates Document Description If GFI DEL. SCHED. Checked Above)	QTY PER HULL	HULL NUMBER FY 1970 (7) 963	FY 1970 (6) 964	FY 1971 965	FY 1971 0966	FY 1972 967	FY 1972 968	969
(1)	(2)	(3)	(4)	(5)	(8)						
1	1		Equipment for BPDSMS Installation Test	1	1/10/71	4/20/71	1/10/72	4/20/72	5/25/72	1/10/73	3/15/73
2	5		Training Missile	1	1/30/71	5/10/71					
3	9		Dummy Director MK 3/8 (Dwg. XXX)	V					1/5/71 (2)	4/15/71 (1)	
4	7		Power Drive Test Box (Dwg. XXX)	V					1/5/71 (2)	4/15/71 (1)	

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Enclosure (1)

APPENDIX H

TEST AND EVALUATION CASE

A. BRIEF

This case investigates the Operational Test and Evaluation (OT&E) process in the procurement life cycle of the patrol frigate. The case studies some of the recent changes in test and evaluation concepts brought about by the recommendations of the Blue Ribbon Defense Panel and DODI 5000.1. The initial Patrol Frigate test and evaluation plan is reviewed and then contrasted with the two alternative plans. Major issues concerning land based test sites, whole-ship initial operational test and evaluation, and number of shipyards to be used are considered. The student is required to develop his own test and evaluation plan for the patrol frigate using the proposals included in the case as guidance.

B. OBJECTIVES

During investigation of this case the student will develop an understanding of:

1. Recent changes in test and evaluation concepts.
2. The distinction between operation and developmental testing.
3. The relationship between test and evaluation and the DSARC.
4. Whole-ship initial operational test and evaluation.
5. The concept of land based test sites.
6. The initial patrol frigate test and evaluation plan and and its alternatives.
7. Test plan preparation.

C. BACKGROUND

Test and Evaluation is an integral and continuing part of the acquisition cycle. In the process of gaining knowledge from research through development and production, some test and evaluation occurs each step of the way. Evaluation of material prior to approval for service use is a vital function. In the past, it too often has been compromised as attempts were made to meet fixed deployment dates even though programs slipped in their earlier stages.

On 1 July 1970 the results of the Blue Ribbon Defense Panel were published. The report made a clear distinction between operational test and evaluation (OT&E) and functional, engineering, or developmental testing (technical). OT&E determines to what extent a given system or material can meet operational requirements. It must provide knowledge as to what the capabilities and limitations will be when the system is subjected to the stresses of the environment for which it was designed, usually combat. Operational testing must take into account the interface with other systems and equipment, tactics, techniques, organizational arrangements, and the human skills and frailties of the eventual users. Developmental testing is done to determine whether design and performance contractual specifications are met. The report concluded that OT&E had not been adequately managed or supervised at the OSD level and that a "higher-than-service" level OT&E organization was needed if the potential of OT&E was to be realized.

Mr. Fitzhugh's Blue Ribbon Committee saw great potential in a program of well-managed OT&E. They also recognized prototyping and preproduction operational testing as more reliable than weapons systems analysis in the form of reams of paper.

Secretary Packard issued Dep. Sec. Def. memos pertinent to OT&E in February, April, and August of 1971. The first directed that each of the Services establish an agency which is separate and distinct from the developing command, and which reports the results of its test and evaluation efforts directly to the Chief of the Service. In addition the memo advised the establishment of a Deputy Director for Test and Evaluation within DDR&E. The April memo presented the requirements for the flow of T&E information in terms of program milestones. The August memo to the Service secretaries re-emphasized that operational test and evaluation will be accomplished prior to the decision to go into full production. The memo also stated "this initial operational test and evaluation will be accomplished with operational personnel in as realistic an operating environment as possible and where practical, will use pilot or early production items."

On 13 July 1971 DOD Directive 5000.1 was published. This directive further clarified the program decision-making process and emphasized that anyone involved with RDT&E must acquire and understanding of DSARC concepts. The T&E effort was discussed as follows: "Test and Evaluation shall commence as early as possible. A determination of operational

suitability, including logistic support requirements, will be made prior to large-scale production commitments, making use of the most realistic test environment possible and the best representation of the future operational system available. The results of this operational testing will be evaluated and presented to the DSARC at the time of the production decision."

In response to DOD Directive 5000.1 the Secretary of the Navy issued SECNAVINST 5000.1 for implementing the new provisions. Due to the wide variety of naval weapons, the Instruction allows varying approaches to the conduct of test and evaluation. However, such effort shall be tailored to the needs and characteristics of each individual acquisition with prime consideration being given to adequate operationally oriented testing. Normally, the following general sequence of events should prevail: 1) laboratory/contractor preliminary test and evaluation of breadboard demonstration hardware during the conceptual effort, 2) contractor/development activity test and evaluation of subsystems and/or full-scale prototype during full scale development, 3) technical test and evaluation conducted by the contractor with Navy participation during pre-production/production, 4) initial operational test and evaluation (IOT&E) by or with the active participation of Navy operational forces prior to the major production decision, 5) Navy OT&E prior to approval for service use and inventory acceptance.

Although this approach to test and evaluation appears conceptually good, production of a system might have to be

delayed one to two years to allow completion of the operational testing. In the Patrol Frigate (PF) program the delay to the program of waiting until the lead ship was built and operationally tested to start construciton of the follow on ships was initially estimated to be about 15 months. The urgency of the PF acquisition is the result of well established block obsolescence of our WWII vintage surface combatants and the increasingly complex and capable threat, both contemporary and projected. According to OP-03D, the PF acquisition schedule recognizes this urgency but does not over-react to it even though projected ship retirements will drive force levels below the "reasonably attainable" levels in the JSOP. Delays of this duration would drive this already undesirable, but acceptable, dip in force levels further toward an unacceptable force level shortfall. Can delays of this magnitude and other resulting consequences be accepted in a major systems acquisition? The Patrol Frigate program seems to be the first test case in this area.

D. THE INITIAL PATROL FRIGATE TEST AND EVALUATION PLAN

Supplementing and anticipating the lead ship construction, two individual, full-scale land-based test sites (LBTS) would be erected for the propulsion and combat systems respectively. In addition to validating the ship engineering aspects of installation and integration of the critical Patrol Frigate systems, the two land-based test sites would provide the facilities to assist in the configuration management of the

Patrol Frigate propulsion and combat prototype systems. In concept throughout the life of the PF program, these sites would be used to evaluate change proposals prior to application to the ships. The sites would be controlled to insure that the LBTSs are a realistic prototype of the PF combat and propulsion system. After the initial validation of system integration, the two land-based test sites would also be used to validate operation, maintenance and support concepts proposed for the PF.

The central relationship of these test sites to the ship acquisition schedule is presented in Figure 1. Land-based testing is to be used in concert with IOT&E plans for individual equipments not now in inventory. This should allow achievement of the requisite level of confidence in ship and equipment engineering before a commitment is made to produce either in quantity. The land-based testing and equipment IOT&E schedules provide for proofing of key systems beginning two years before completion of the lead ship. This coincides with the planned award date for follow-ship construction contracts, shown by the vertical time line.

According to Capt. Otth, the PF SHAPM, to further build confidence in the validity of the PF design for the follow ships, the start of follow-ship construction is contiguous with completion of lead-ship fabrication. Thus the detail design would be 42 months mature and validated by the start of series production of Patrol Frigate ships.

PF PROGRAM STRUCTURE

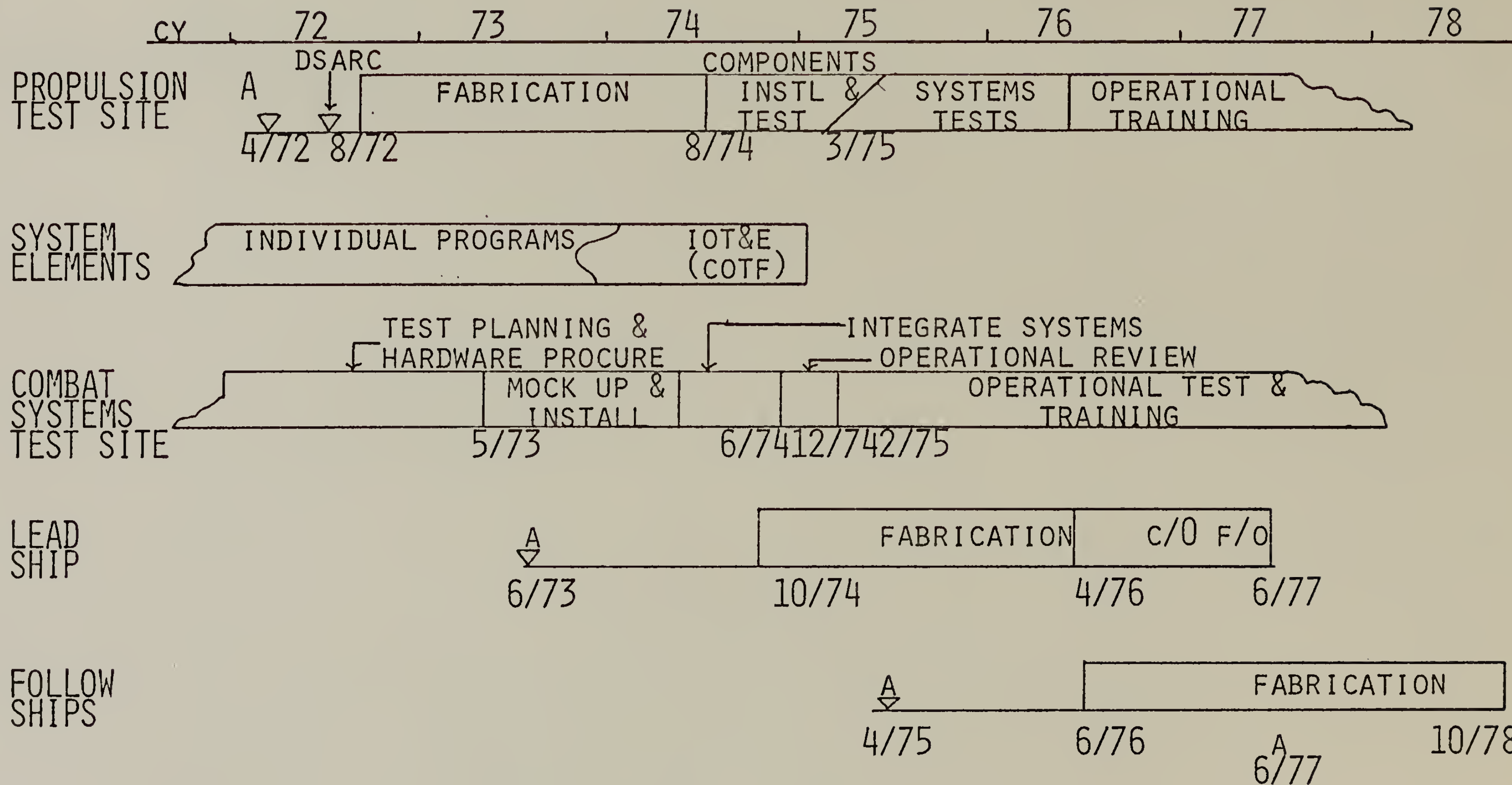


Figure 1

The PF SHAPM has identified the integration of the combat system as a critical task in the Patrol Frigate development effort. Because of its critical nature the integration effort will be decoupled from the time critical events of the shipyard and conducted at Land-Based Test Sites. This approach should allow sufficient management and engineering attention to be focused on the task to establish the validity of the combat system design before the PF shipbuilding phase.

The Patrol Frigate combat system Land-Based Test Site should be a genuine prototype of the PF combat system. Its creation early in the PF development process should provide the opportunity and the mechanism to validate and document not only the combat system engineering process but also the installation, test and checkout, and operation and maintenance procedures prior to the delivery of the first PF.

In order to satisfy these objectives the PF SHAPM is planning to aggregate at the site three essential functions:

1. A functional Checkout Facility to validate the system engineering and electrical compatibility of the equipment.

2. A Computer Program Checkout Facility to debug the combat system computer programs.

3. A Physical Mockup to validate the design and to be the ultimate recipient of the results of the above efforts. The Physical Mockup will be the combat system prototype.

Throughtout the life of the PF Program the LBTSs should be used as an integral part of the PF configuration management program. The SHAPM should require that all change proposals be evaluated at the appropriate LBTS before they are considered by his change control board. Once engineering solutions have been validated at the LBTS the configurations will be frozen and controlled.

The design and development of the site should commence in late calendar year 1972 concurrent with the beginning PF Detail Design. The site should be fully operational in mid-1974. The availability of the site and its ability to generate data which can provide an initial assessment of the PF's operational capabilities is central to the establishment of the February 1975 date as the target for PF DSARC III. The site is designed to support the PF development through the life of the PF Project, by providing a land based testing source for installation, test, and operational experience before delivery for the first PF (6/77).

Because the LBTSs are designed to be replicas of the ultimate PF systems they offer the means to develop, document and validate critical portions of the Total Ship Test Plan (TSTP), before the test procedures are required for use on the lead and follow ships. The PF TSTP will be provided to the lead and follow shipbuilders for execution to ensure the PF is constructed in accordance with the Navy's intent. However, the PF TSTP will cover all ship systems. The opportunity afforded by the LBTS should allow the combat and

propulsion system test procedures to be developed with minimum redundancy before use on the lead ship. Before implementation on the follow ship the entire TSTP will be validated through analysis of lead ship testing in order to ensure a least-redundant TSTP.

Patrol Frigate compliance with DODIR 5000.1 is based on a four step approach to providing a capable fleet unit:

1. Selected equipment is service approved,
2. Equipment is integrated into ship systems,
3. Ship systems are installed in the hull.
4. Ship is operated at sea.

The first two steps are to be accomplished in parallel prior to DSARC III and should provide sufficient data to allow a reasoned decision relative to the PF follow-ship program.

The problem that the PF SHAPM anticipates is one of structuring and communicating the sense of the data once it is assembled. Thus he has undertaken to work with Applied Physics Laboratory to develop a systematic approach to integrating the data available from the various Navy development projects as well as data available from the PF Land Based Test Site. The objective is to identify measurable engineering parameters which are necessary to the establishment of the PF performance characteristics, then to match these parameters against testing opportunities to insure that all available data is considered at DSARC III and to minimize redundant testing for the PF. Additionally, this effort should allow the PF Land Based Test Site program to complement

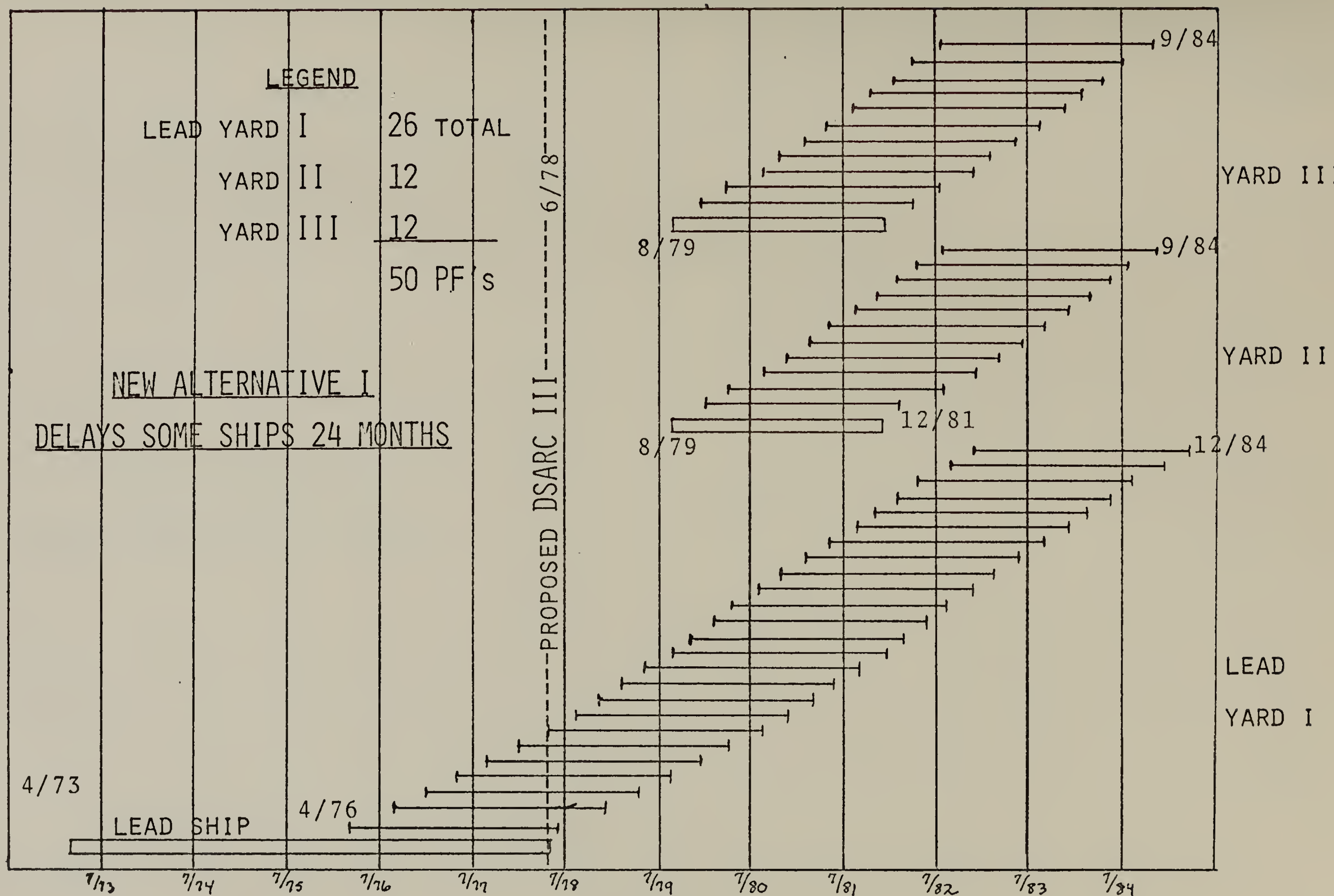
the at-sea testing of individual equipments and to identify at-sea requirements that could be satisfied by other existing development programs. However, this approach does not obviate the need for an at-sea evaluation of the PF. The approach allows for a DSARC III decision on the basis of the initial assessment of the PF's operational capabilities before at-sea trials and will identify areas where rigorous at-sea evaluation is required.

E. ALTERNATIVE TEST PLANS

According to the initial PF test plan it is apparent that the IOT&E would be completed and the results available only after all contracts are finalized and fabrication has begun on about half of the 50 ships in the contract. It is important to note that when construction begins simultaneously at the three shipyards, the results of IOT&E on the lead ship as a unit are not available and would not become available for two years. Should the members of the DSARC consider themselves obligated to be responsive and letter strict to the requirements of DODINST 5000.1 and the desires expressed by Congress in Public Law 92-156 Section 506, covering their desire for appropriate operational test reports, the initial PF test plan would be unacceptable. However, if whole ship IOT&E is to be completed and results published and analyzed before the initial production decision the delay in delivery of each ship could be as much as three and a half years. According to the CNO, the requirements of the Navy make this unacceptable. A

middle ground introducing considerably less delay might be more appropriate. In other weapon system acquisition programs, RDT&E has agreed that continuation of production at one source before the major production decision is an appropriate measure to reduce program costs and additionally provide units on which to conduct further OT&E. This precedent indicates the OSD criticism would be directed only toward the beginning of production at the second and third shipyard in advance of the results of IOT&E from the lead ship.

In an effort to provide additional alternatives, more convincing to OSD that the Navy is inserting appropriate OT&E into the procurement of ships, COMOPTEVFOR proposed a new alternative which delays production in the second and third shipyard until IOT&E on lead ship is completed. However, production in the initial shipyard would continue. This alternative results in up to 24 months delay for the ships being produced in the second and third ship yard (see Figure 2). A second alternative was suggested as an effort toward reducing delivery delay to the minimum. This alternative delays the completion of the entire 50 ship program by nine months or less as compared with the present test plan (see Figure 3). This second new alternative is in consonance with the first new alternative until DSARC III and the completion of IOT&E on the lead ship. At that time, however, four additional shipyards would be contracted for construction vice two. The addition of two shipyards is made possible by contracting and stockpiling critical subsystems (propeller,



LEGEND
LEAD YARD I 26 TOTAL
YARD II 12
YARD III 12
50 PF's
NEW ALTERNATIVE I
DELAYS SOME SHIPS 24 MONTHS
PROPOSED DSARC III
6/78
9/84
YARD III
8/79
9/84
YARD II
12/81
8/79
12/84
LEAD
YARD I
4/73
LEAD SHIP
4/76
7/73
7/74
7/75
7/76
7/77
7/78
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7/82
7/83
7/84

FIGURE 2

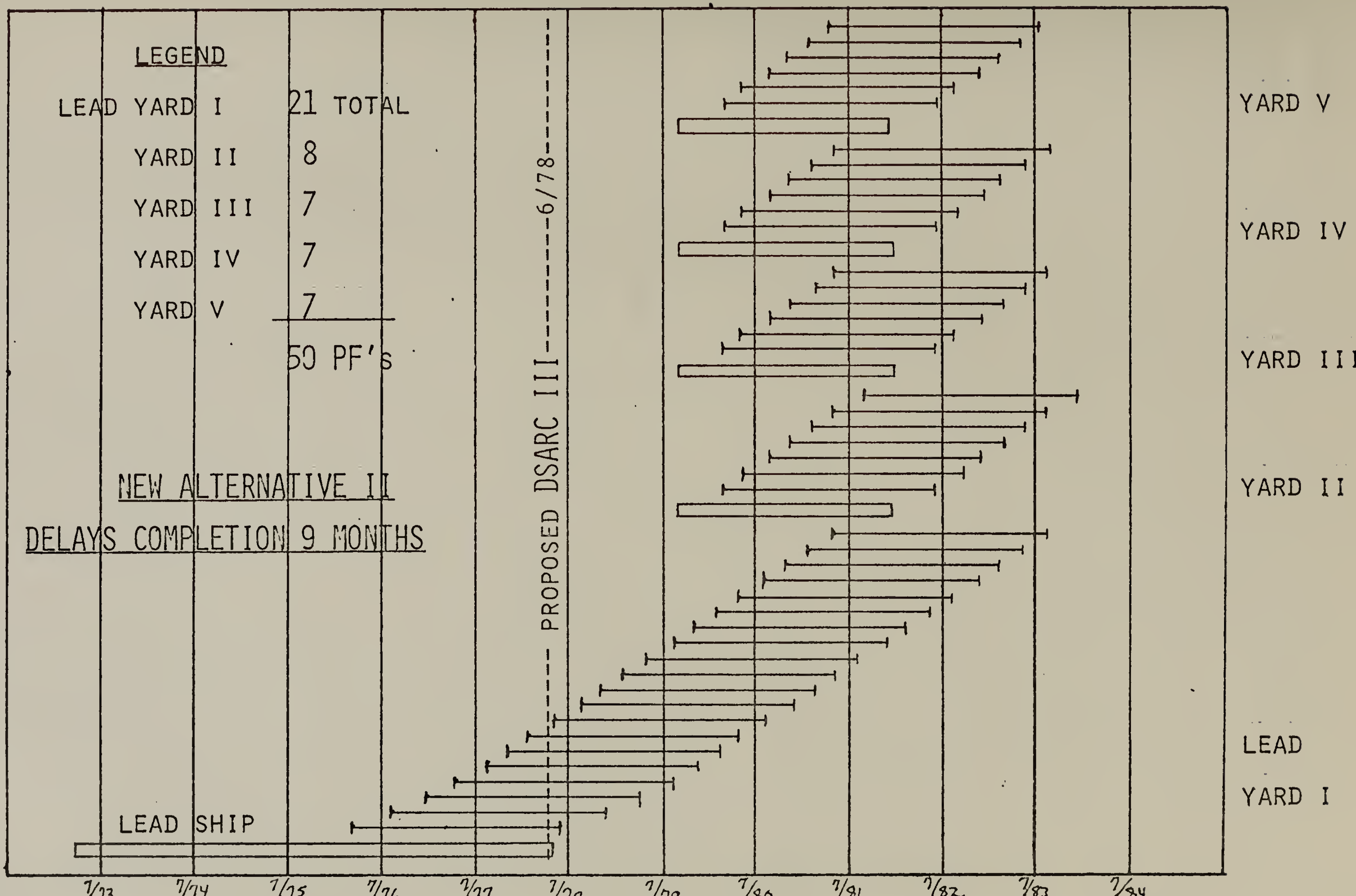
LEGEND
LEAD YARD I 21 TOTAL
YARD II 8
YARD III 7
YARD IV 7
YARD V 7
50 PF's
NEW ALTERNATIVE II
DELAYS COMPLETION 9 MONTHS
PROPOSED DSARC III 6/78
LEAD SHIP
YARD V
YARD IV
YARD III
YARD II
LEAD
YARD I
7/73
7/74
7/75
7/76
7/77
7/78
7/79
7/80
7/81
7/82
7/83
7/84

FIGURE 3

turbine) before completion of IOT&E of the ship and DSARC III. Since these subsystems are apparently low risk items, RDT&E would assist the Navy in making such arrangements. Another consideration favorable to the alternative is the possibility of using naval shipyards in the construction of naval ships. If only these additional shipyards were available, then the delay would be something between nine and 24 months.

F. ANALYSIS OF PROPOSED ALTERNATIVES

Both alternatives propose reorientation of the PF production plan in an attempt to inject whole ship IOT&E into the ship acquisition program. The impact of such an action on the other objectives of the PF program, notably rapid acquisition and minimum cost, is discussed below.

The initial Navy proposed acquisition schedule was structured to reduce total program costs by taking advantage of the significant economies of scale and series production that result from learning curve experience in each of the three production yards now proposed and multi-year procurement of components at a new rate judged to be within the production capacity of vendors. According to OP-0-3D new alternative II would be particularly disruptive of this balance as each of the four follow ship production yards would just reach the peak of the learning curve when production stopped. In addition, delivery of ships in excess of one per month could create problems in vendor representative availability, crew availability and training peaks, and time on ranges for SQT, shakedown training, and other ship delivery trials. The Navy

would also lose the opportunity to make changes between the first and second block ships that is provided for in the DCP proposed schedule. All of these factors would tend to increase costs due to escalation in a stretched program. Though not precisely quantifiable at this time, the DCNO for Surface Warfare indicated that going to five yards for a relatively short period of peak production rather than three yards for a longer production run could reduce the well-established economies that result from competition. This lack of competitive incentive could increase the cost of ships by $1-2 million each. With respect to ship equipments and components, the impact of the new alternatives would be to increase costs by requiring vendors to increase production capacity to meet the requirements of over one per month ship deliveries or to produce components essentially as called for in the DCP proposed schedule and warehouse production items until needed. The delaying of shipbuilding, in which there is essentially no technical risk, and warehousing the components which are most subject to technical risk must also be considered.

G. DISCUSSION QUESTIONS

1. Is whole-ship IOT&E needed in the ship acquisition process?

2. Are landbased tests a meaningful substitute for operational testing?

3. What alternatives exist for conducting sufficient IOT&E on future ship construction to ensure maximum quality relative to cost, while not unduly delaying fleet introduction of the new ship?

H. REQUIREMENTS

Each student will develop an Operational Test and Evaluation Plan for the Patrol Frigate. The three test plan proposals presented in the case may be used for guidance. The student's position on the issues mentioned in the discussion questions should be addressed in the plan. The scope of the tests, test schedule, and shipyard utilization should be included.

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13. ABSTRACT

The acquisition of major weapons systems is an extremely complex process involving many highly interrelated individual operations, each critical to the completion of the final product. This thesis is an examination of the Patrol Frigate Acquisition Project through the development of a series of eight case studies around the major problems that have confronted the program during the initial stages of the procurement life cycle. The case studies are designed primarily for use in graduate level systems acquisition management courses of instruction. Although the cases are intended for use in series, substantial background information has been included in each case to allow separate and individual analysis. The case subjects include project planning, DCP/DSARC, cost estimating, ship specifications, centralized procurement, contracting, Ship Project Directives, and Test and Evaluation.

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